

HOMESTAKE MINING COMPANY SITE

Site Background Standards Discussion

Santa Fe, NM
May 5, 2015

MARK PURCELL AND SAI APPAJI

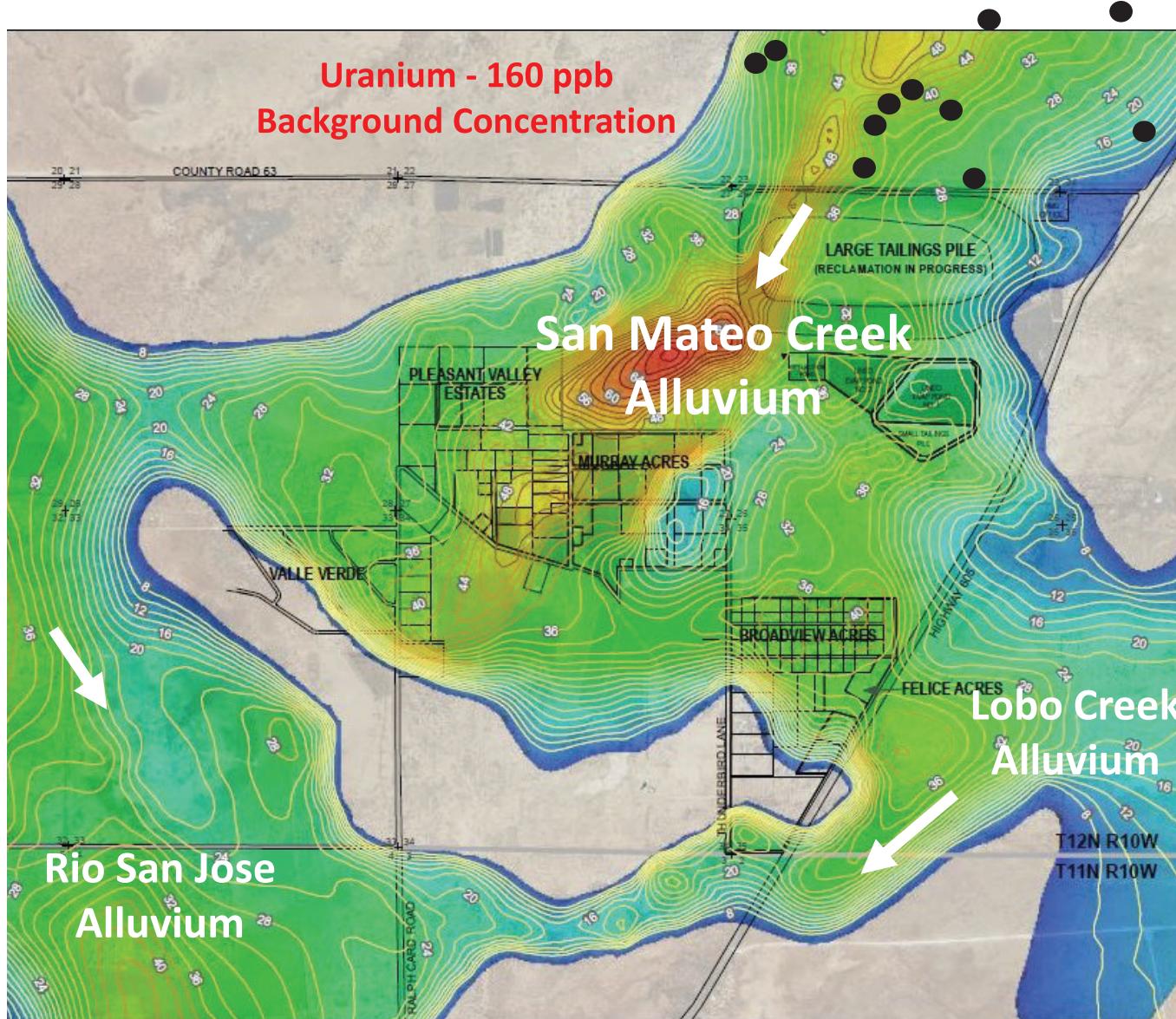
U.S. EPA Region 6



9787557

ALLUVIAL AQUIFER

BACKGROUND WATER QUALITY ASSESSMENT



THREE ALLUVIAL WATER SYSTEMS

Site Alluvium Background Concentrations Based Only on San Mateo Creek Alluvial Water Quality

- Homestake Background Well

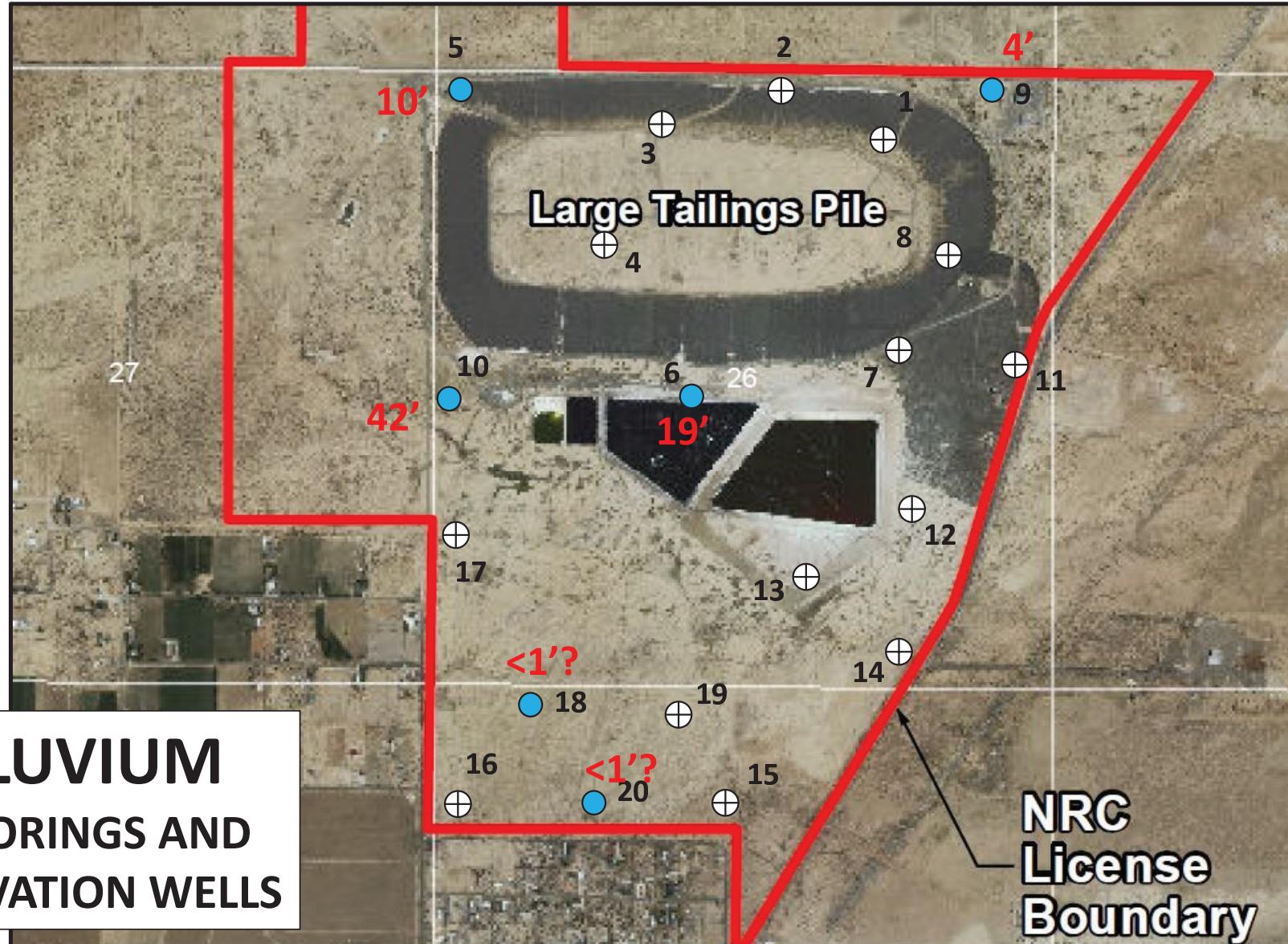
● Water

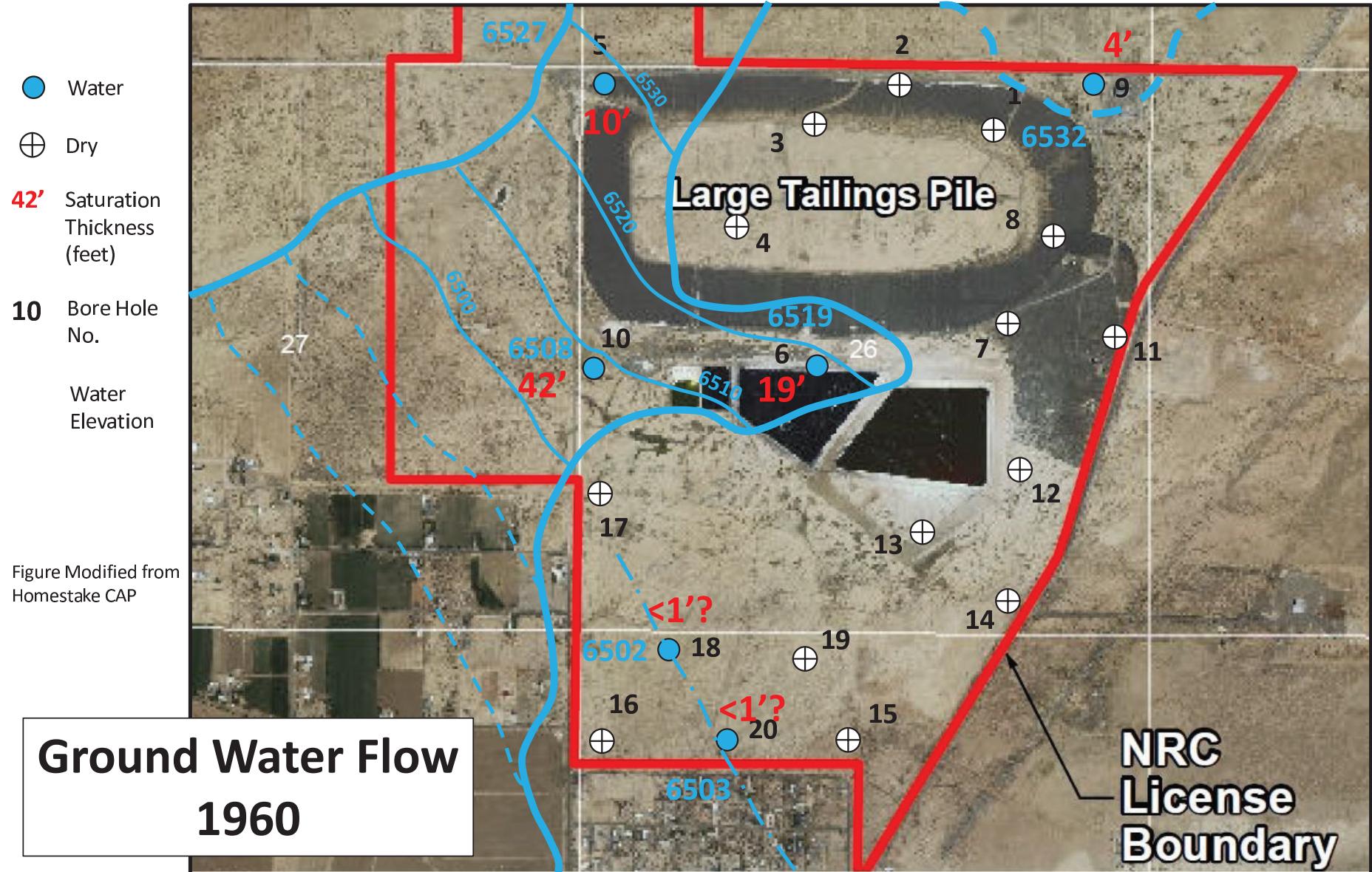
⊕ Dry

42' Saturation
Thickness
(feet)

10 Bore Hole
No.

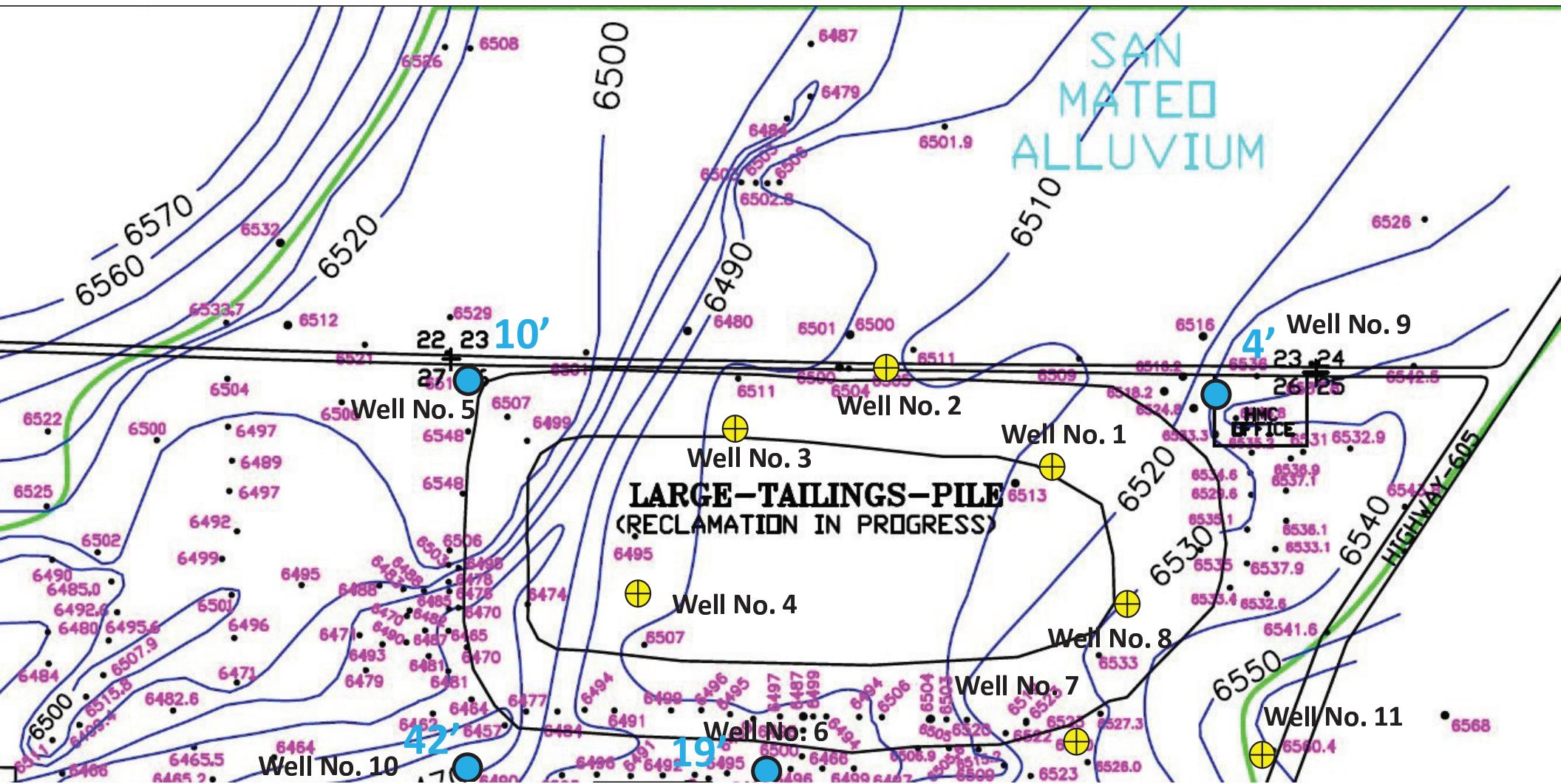
Figure Modified from
Homestake CAP



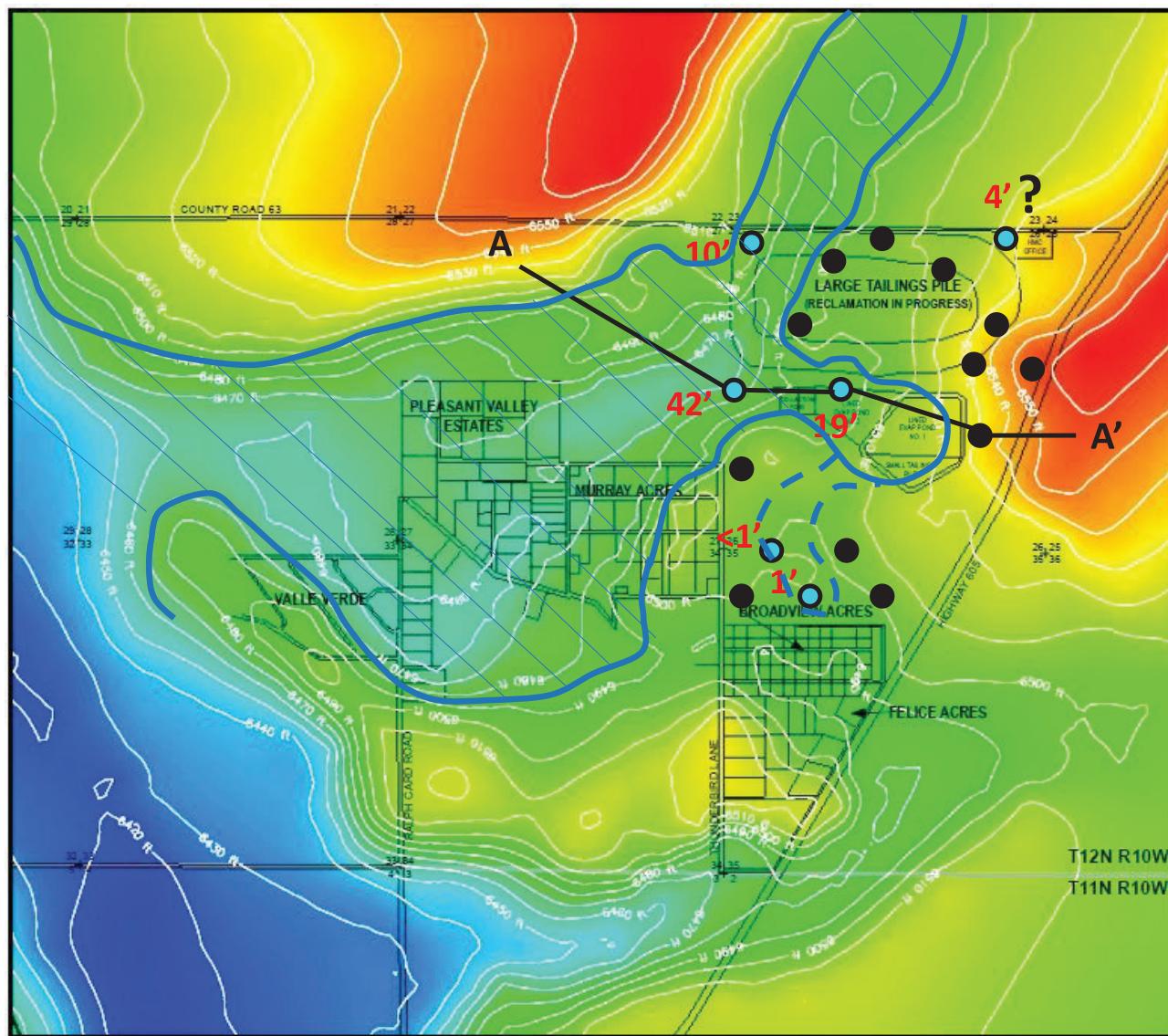


BASE OF ALLUVIUM STRUCTURE CONTOUR MAP

Modified from Homestake Annual Report - 2013



SATURATED ALLUVIUM 1960

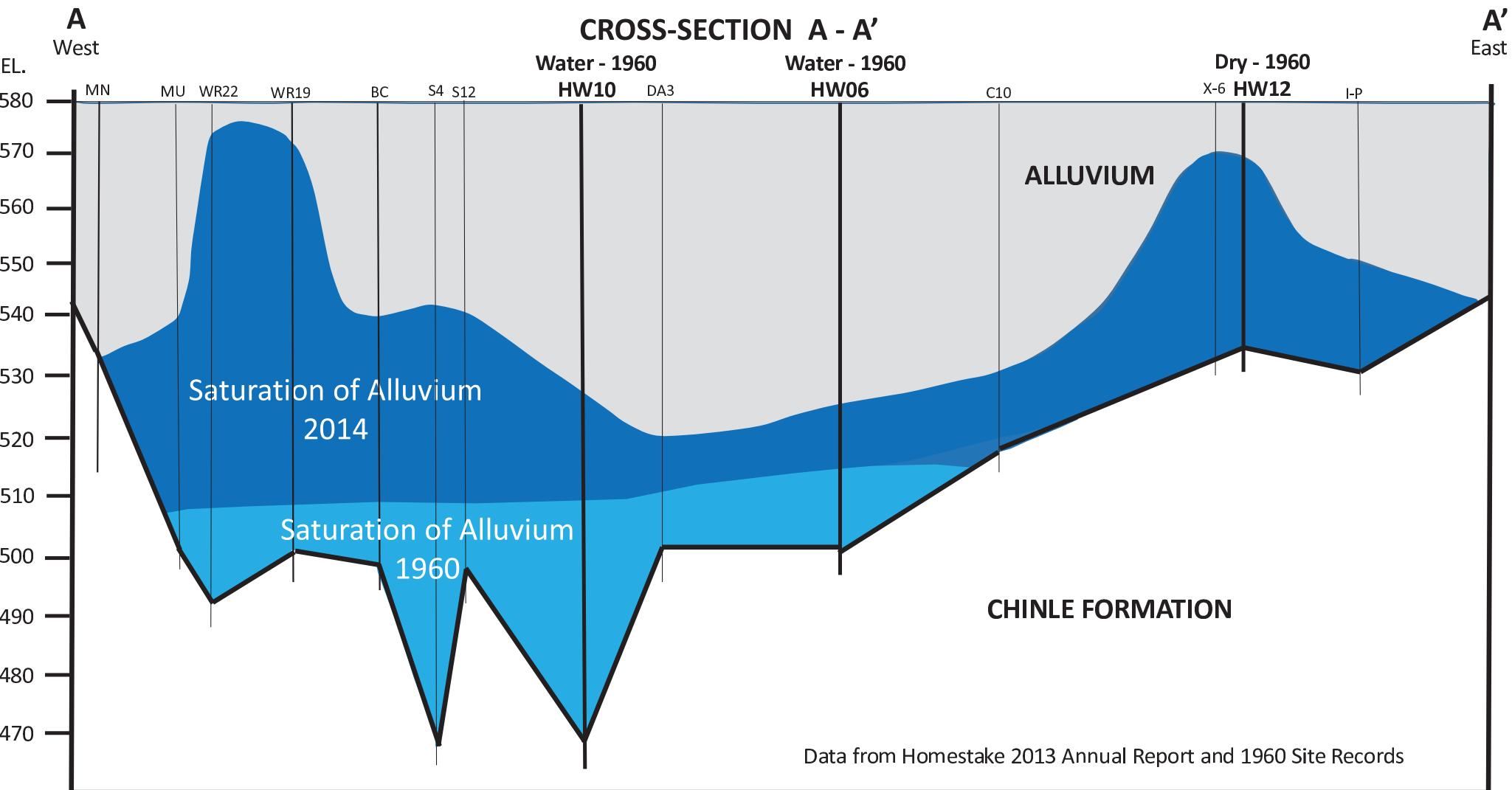


6,570
6,550
6,530
6,510
6,490
6,470
6,450
6,430
6,410

**BASE OF ALLUVIUM
ELEVATION
(FT-AMSL)**

Modified From Homestake CAP

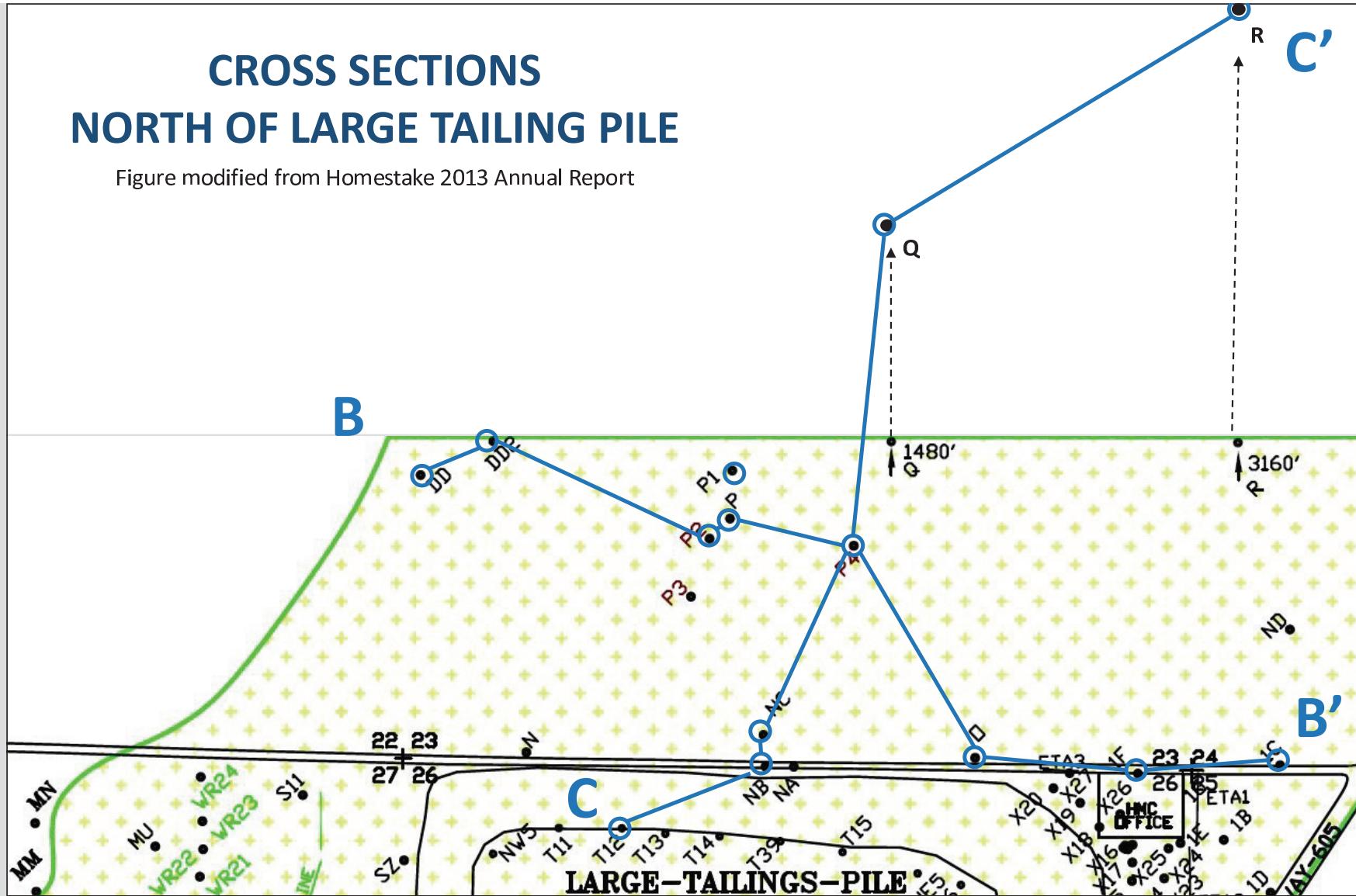
- Water in Borehole
- Dry Borehole



HOMESTAKE MINING COMPANY NPL SITE

CROSS SECTIONS NORTH OF LARGE TAILING PILE

Figure modified from Homestake 2013 Annual Report



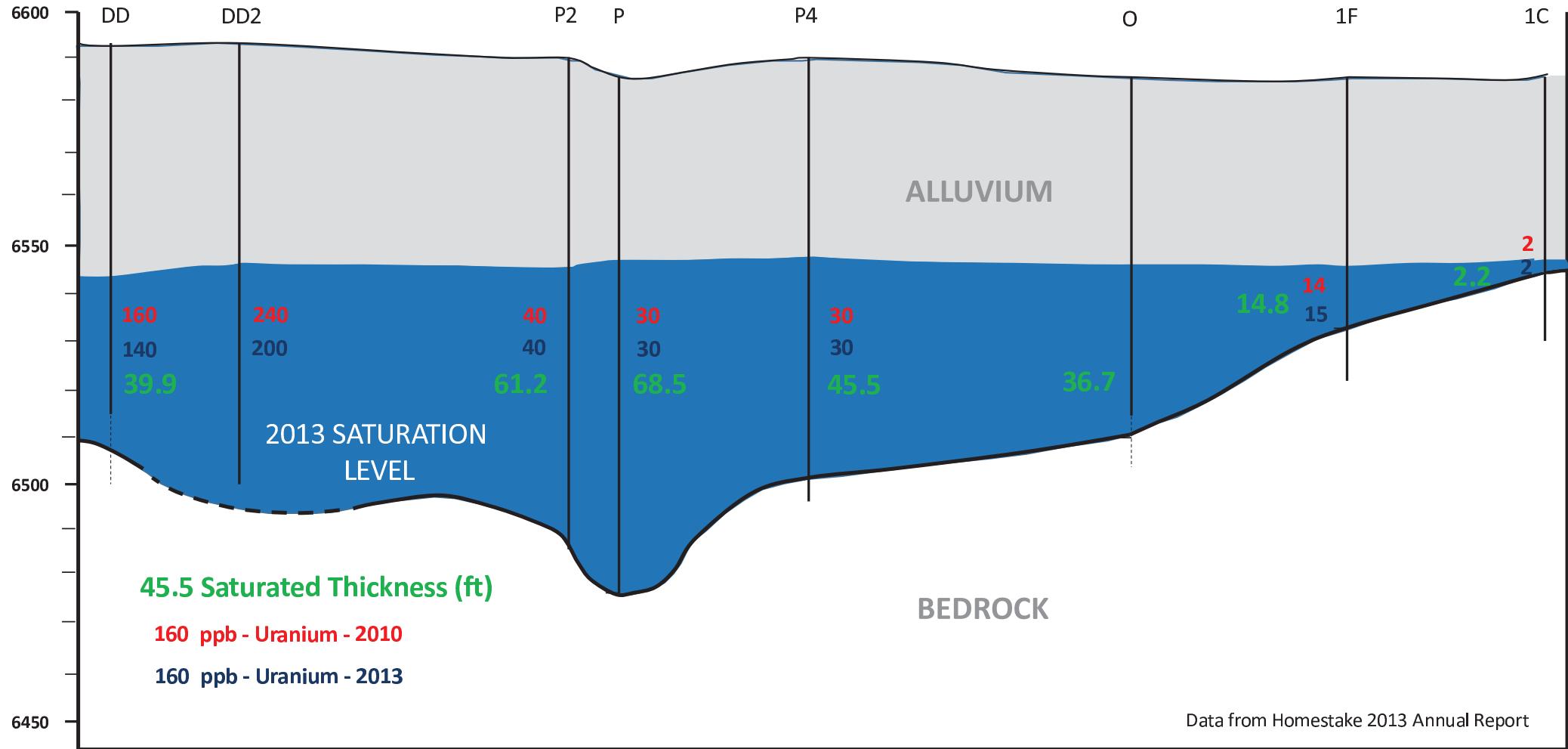
B West

East

B'

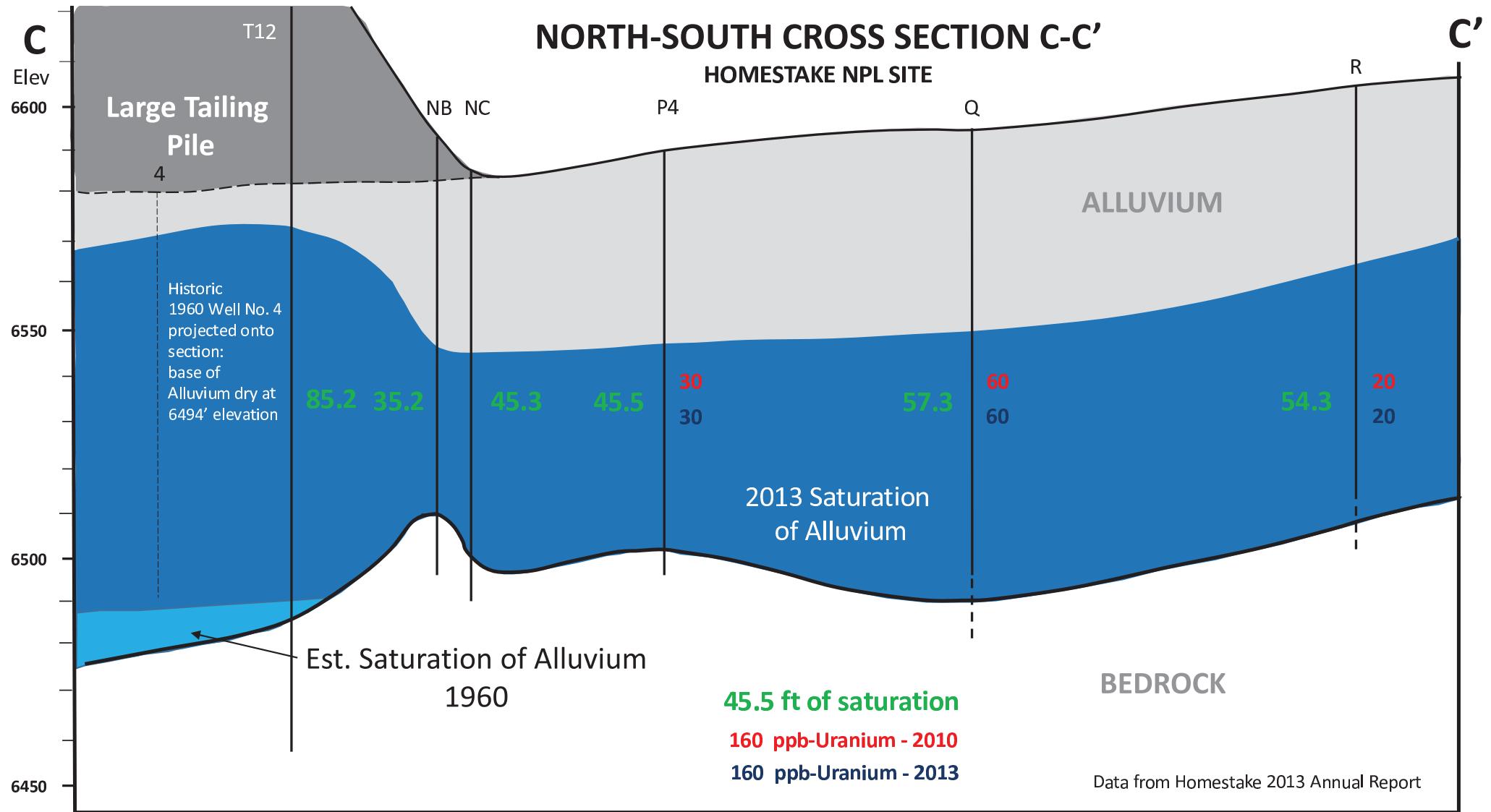
EAST-WEST CROSS SECTION B-B'
AREA NORTH OF LARGE TAILING PILE, HOMESTAKE NPL SITE

Elevation



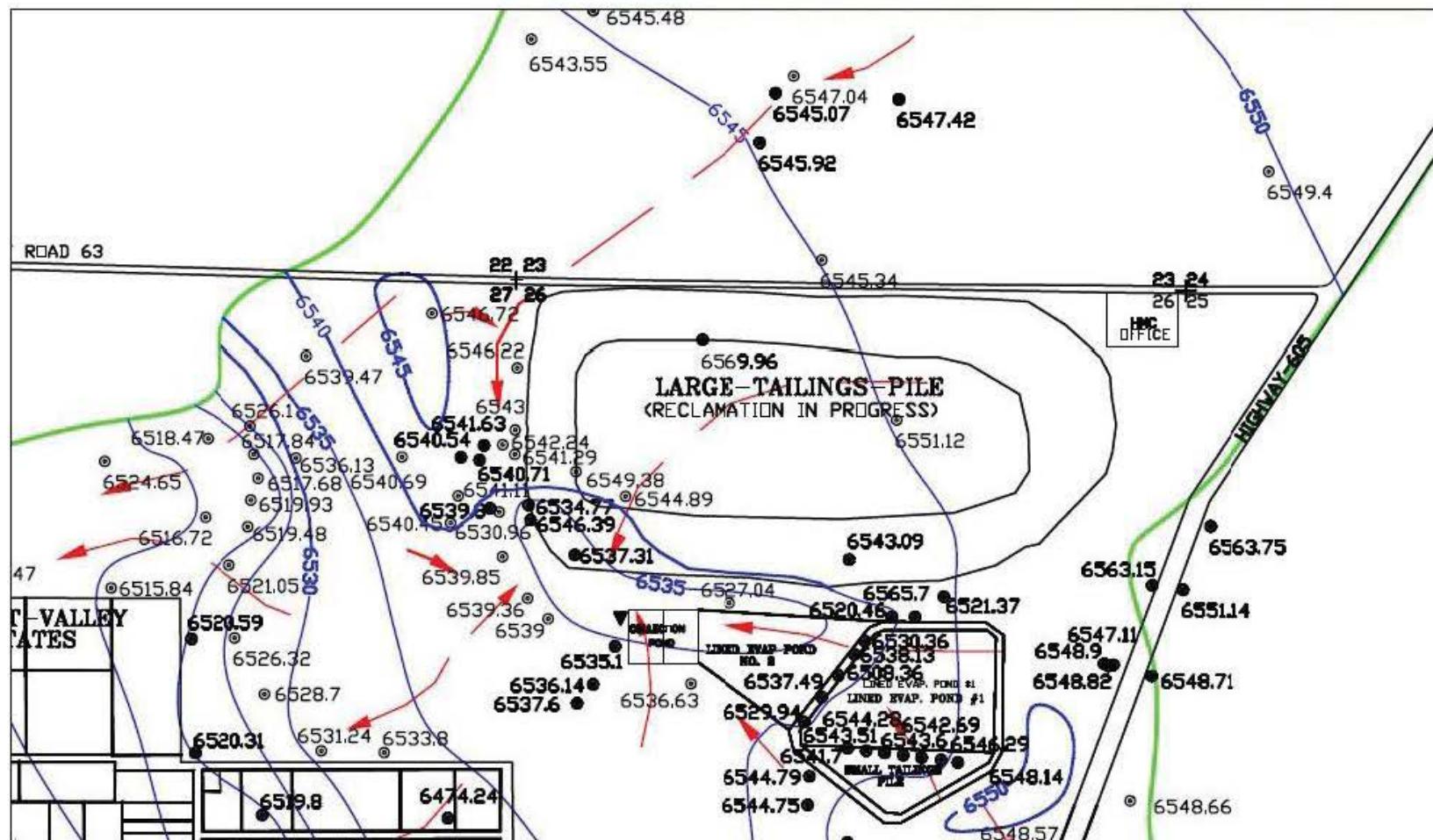
NORTH-SOUTH CROSS SECTION C-C'

HOMESTAKE NPL SITE



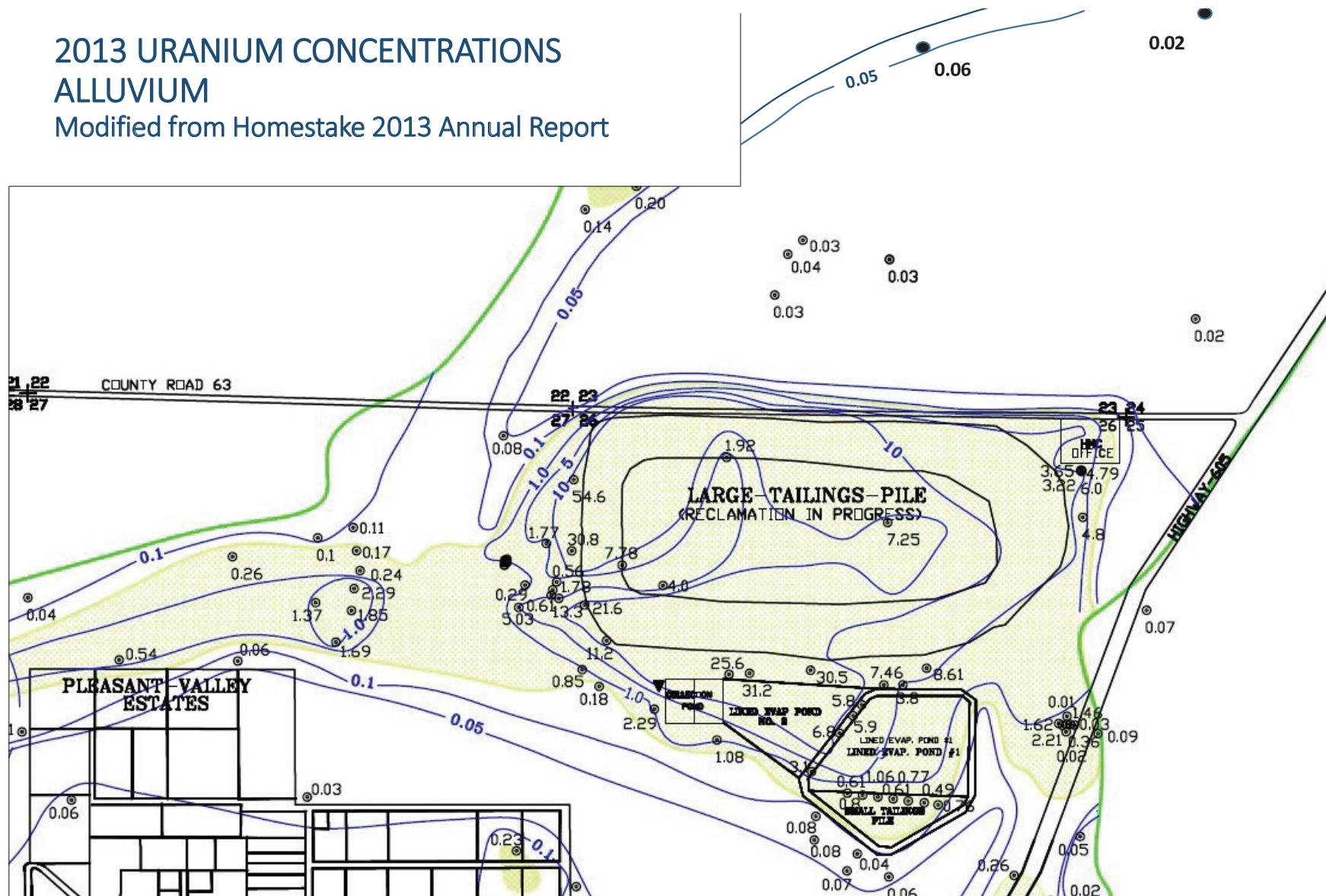
ALLUVIUM POTENTIOMETRIC SURFACE MAP

Homestake 2013 Annual Report



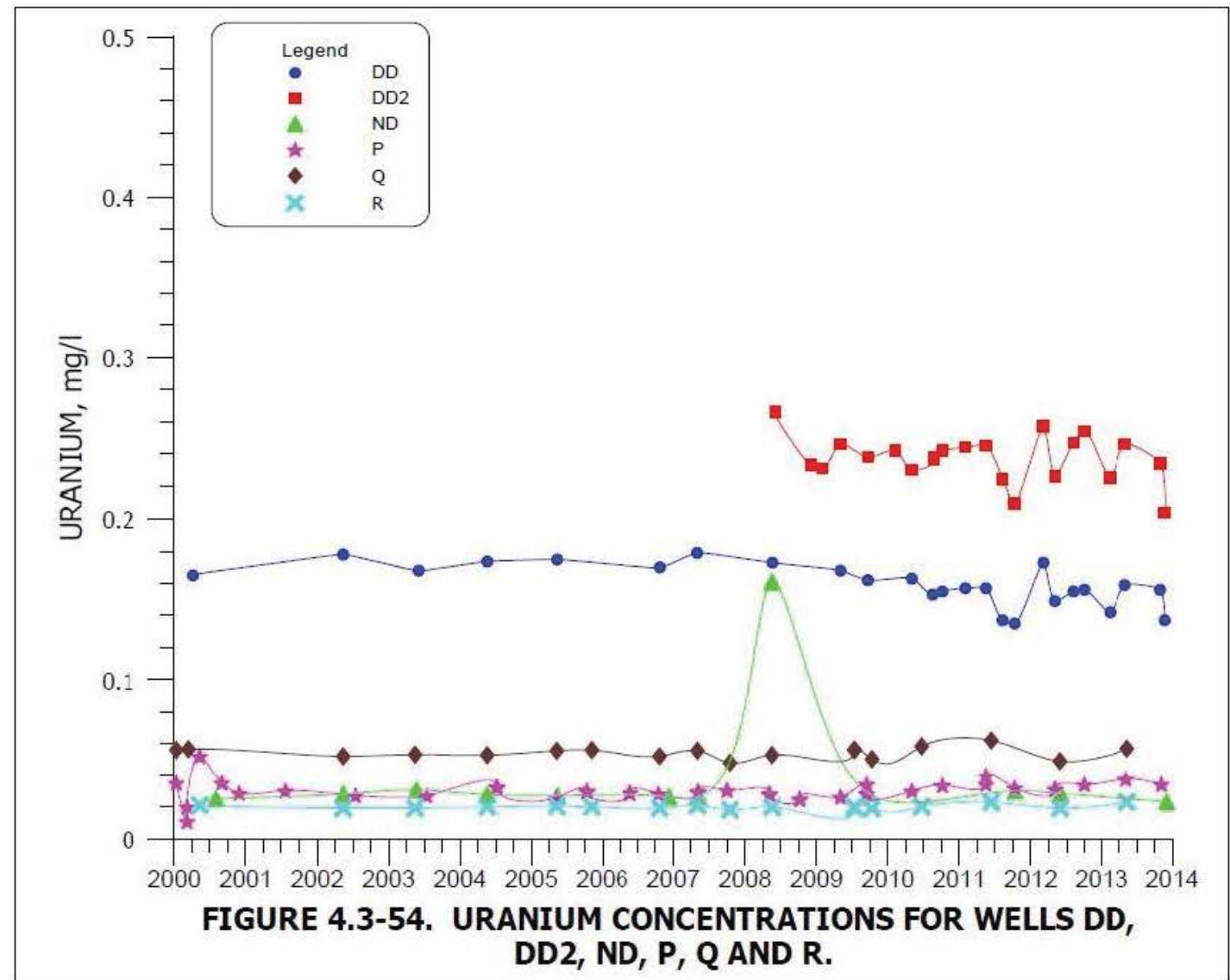
2013 URANIUM CONCENTRATIONS ALLUVIUM

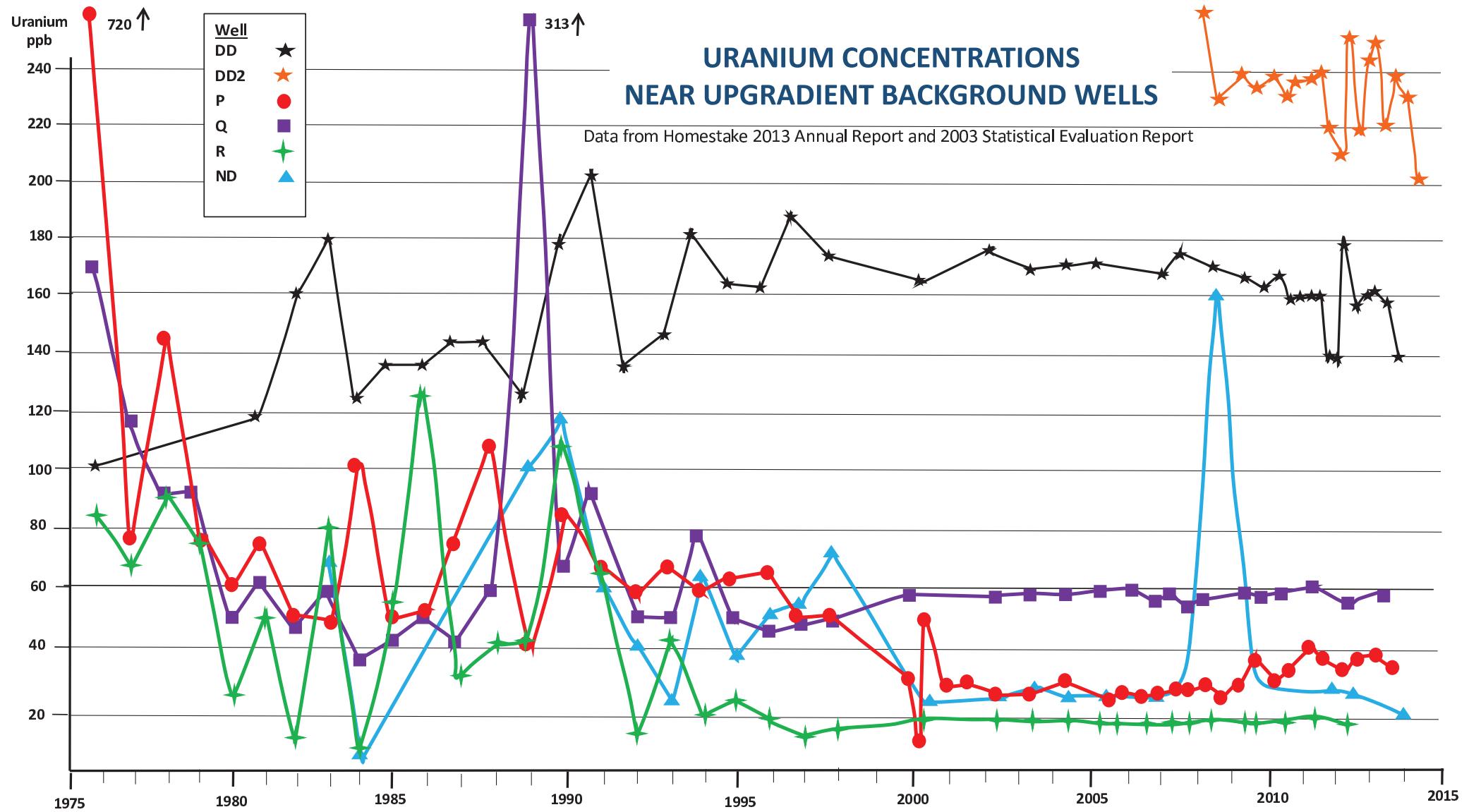
Modified from Homestake 2013 Annual Report



Uranium Concentrations Near Upgradient Background Wells

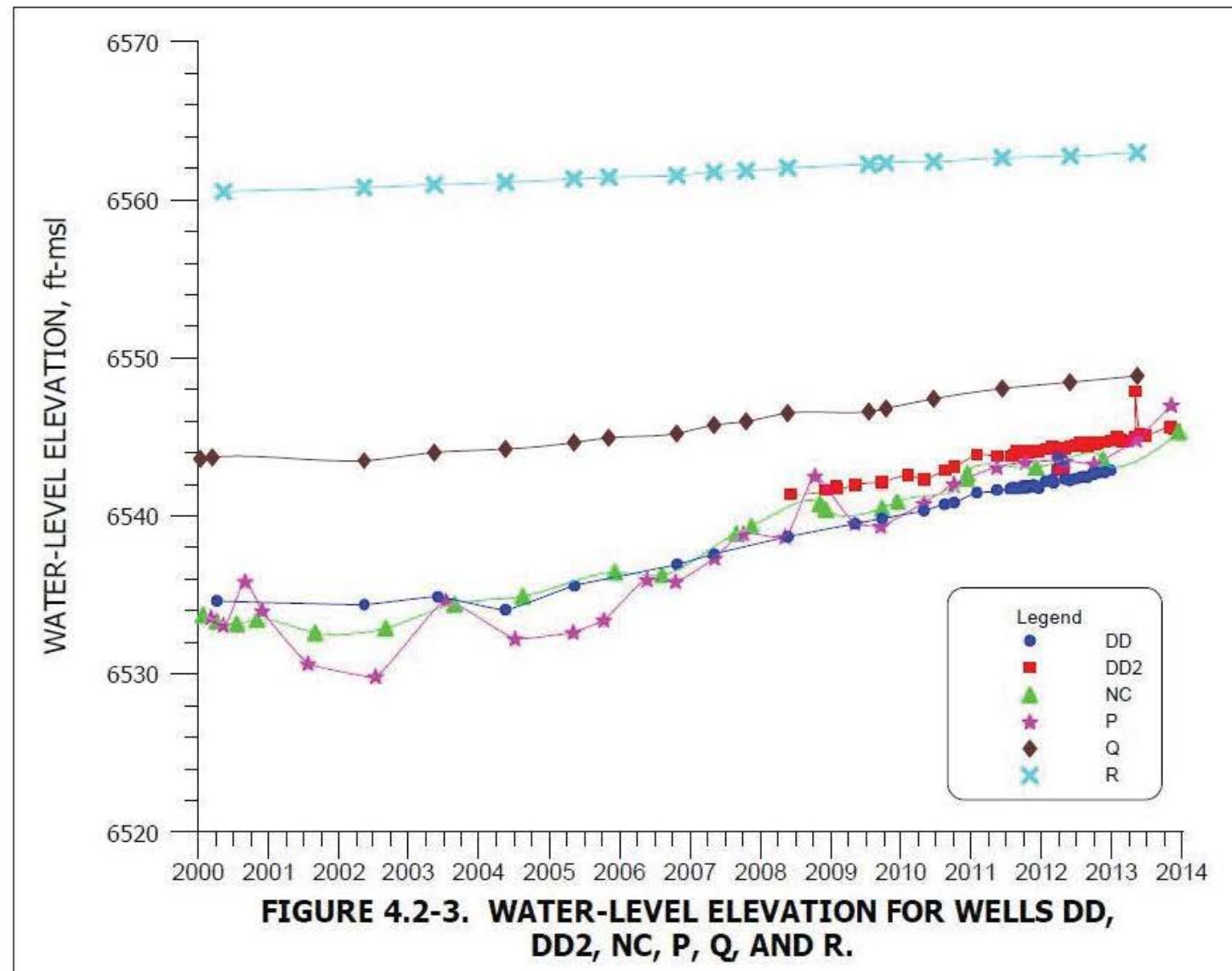
Homestake 2013
Annual Report





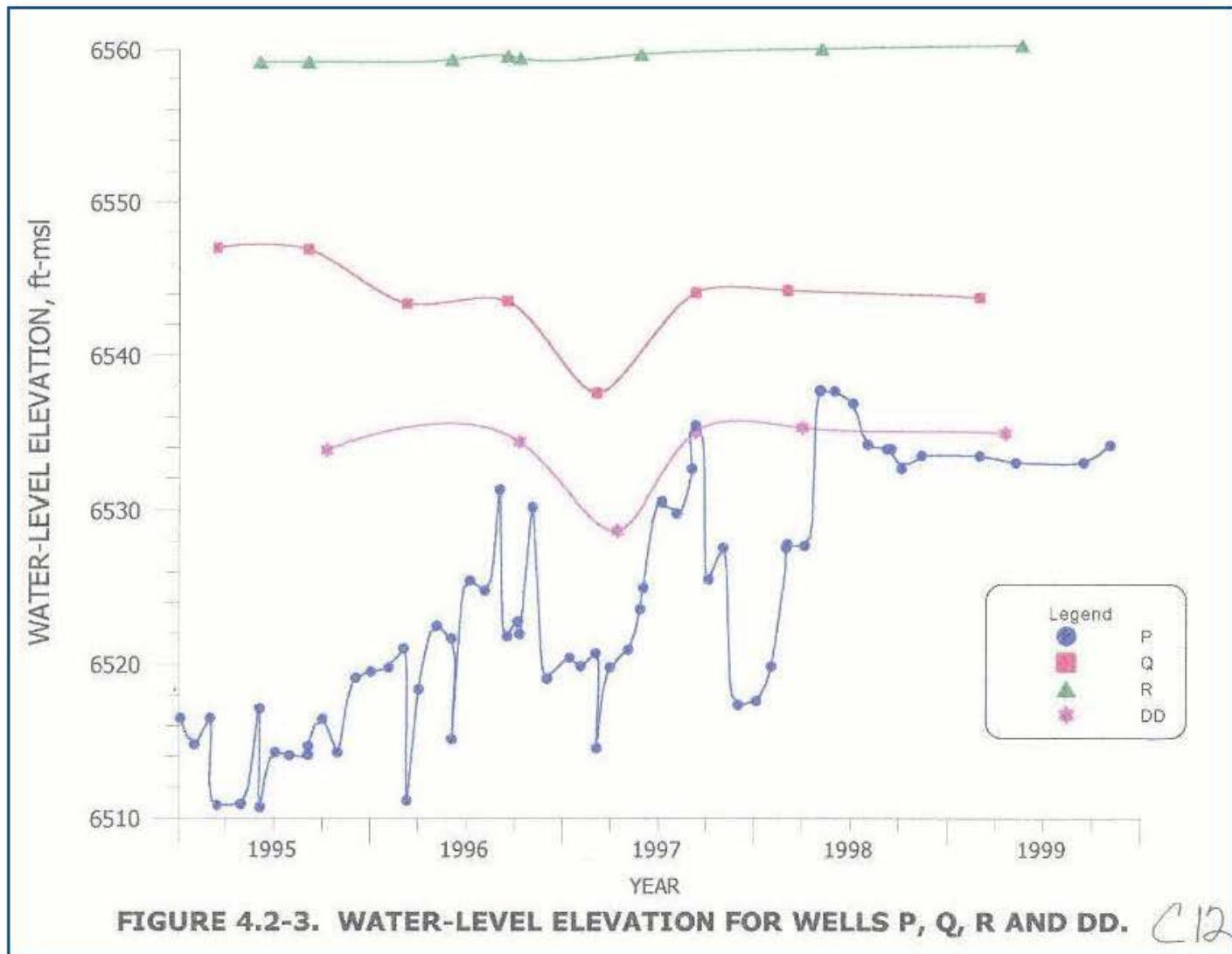
Water Level Elevation Near Upgradient Wells

Homestake 2013
Annual Report



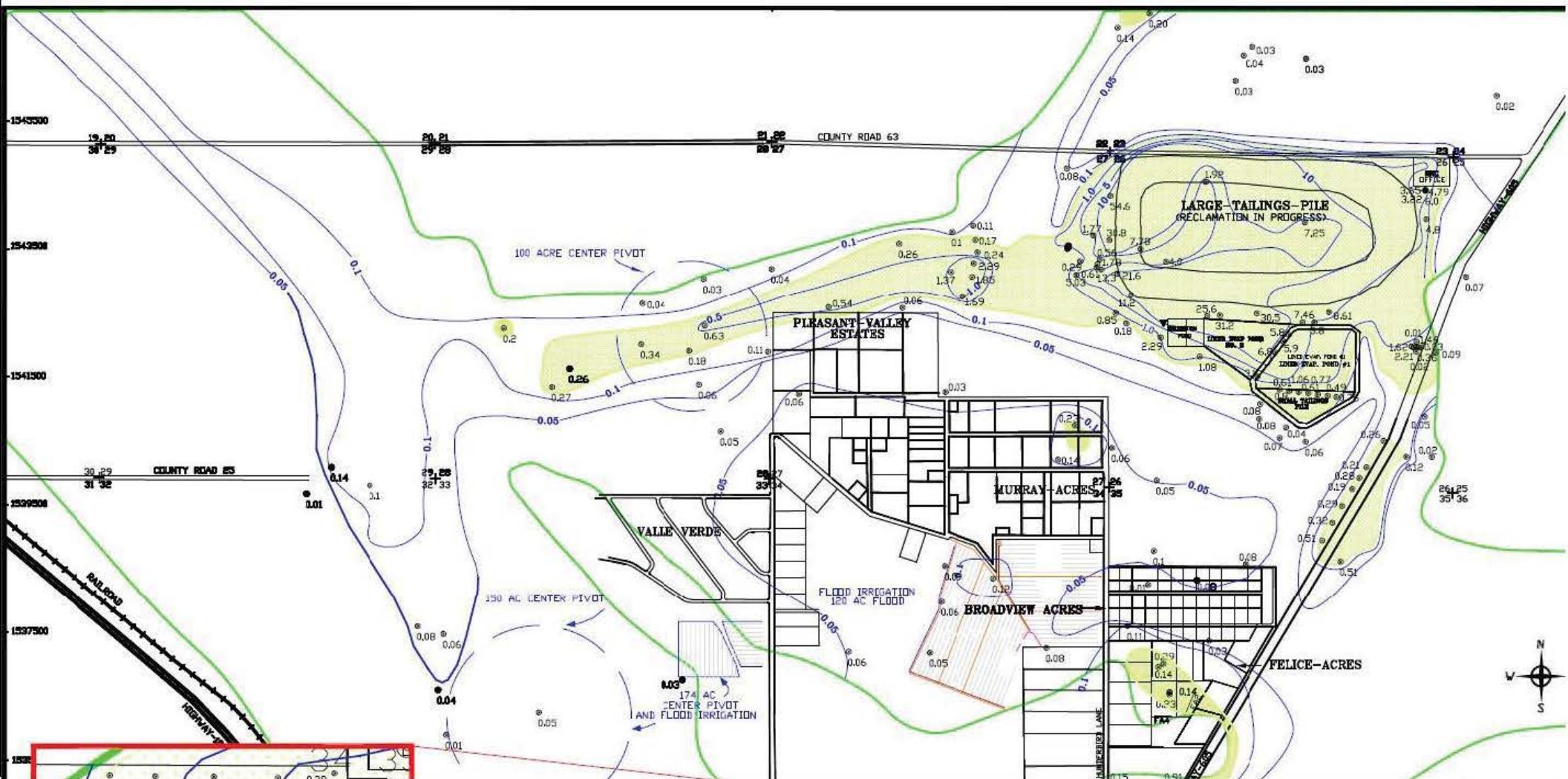
Water Level Elevation Near Upgradient Wells

Homestake 2000
Annual Report



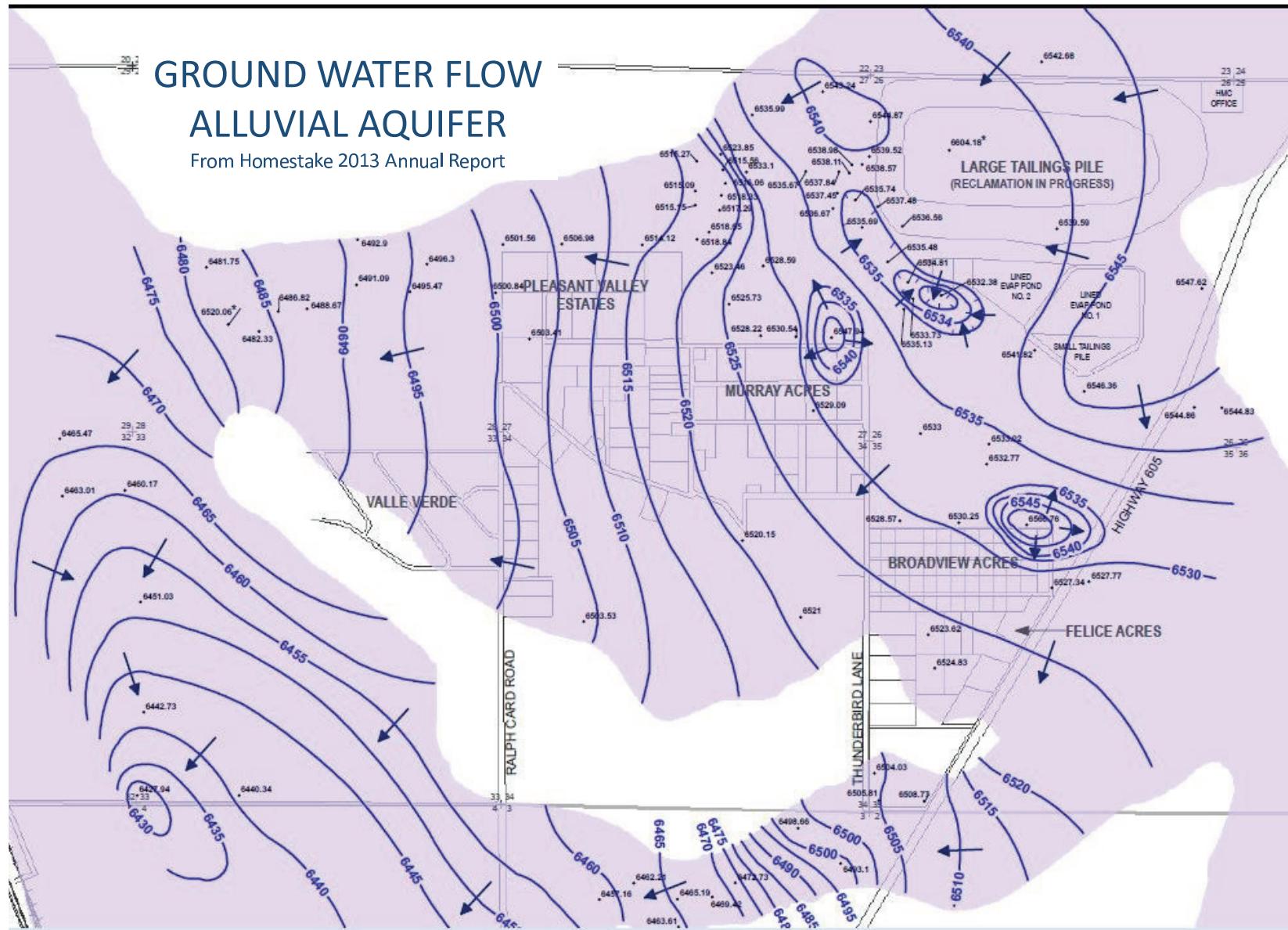
URANIUM CONCENTRATIONS – ALLUVIAL AQUIFER

Homestake 2013 Annual Report

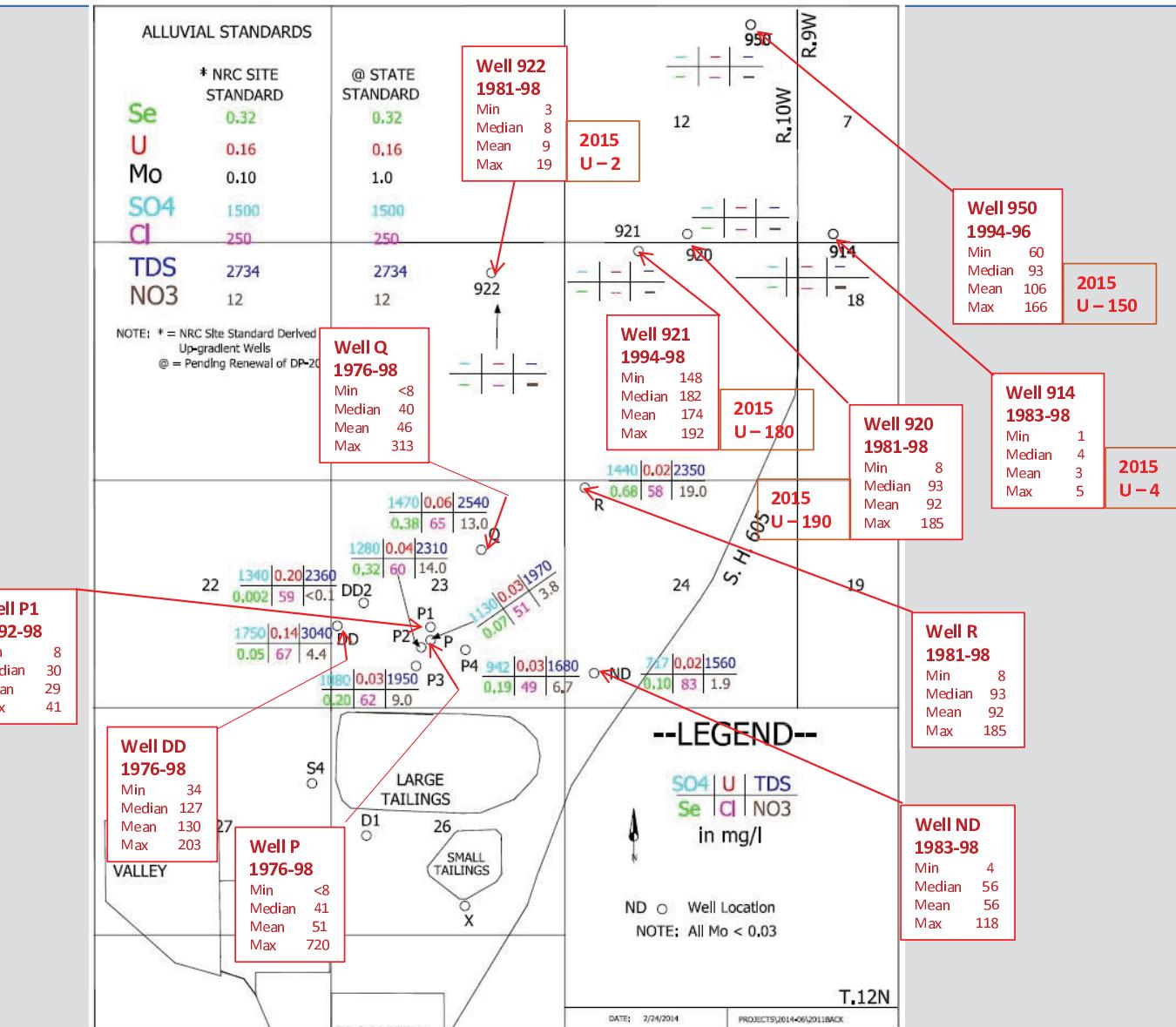


GROUND WATER FLOW ALLUVIAL AQUIFER

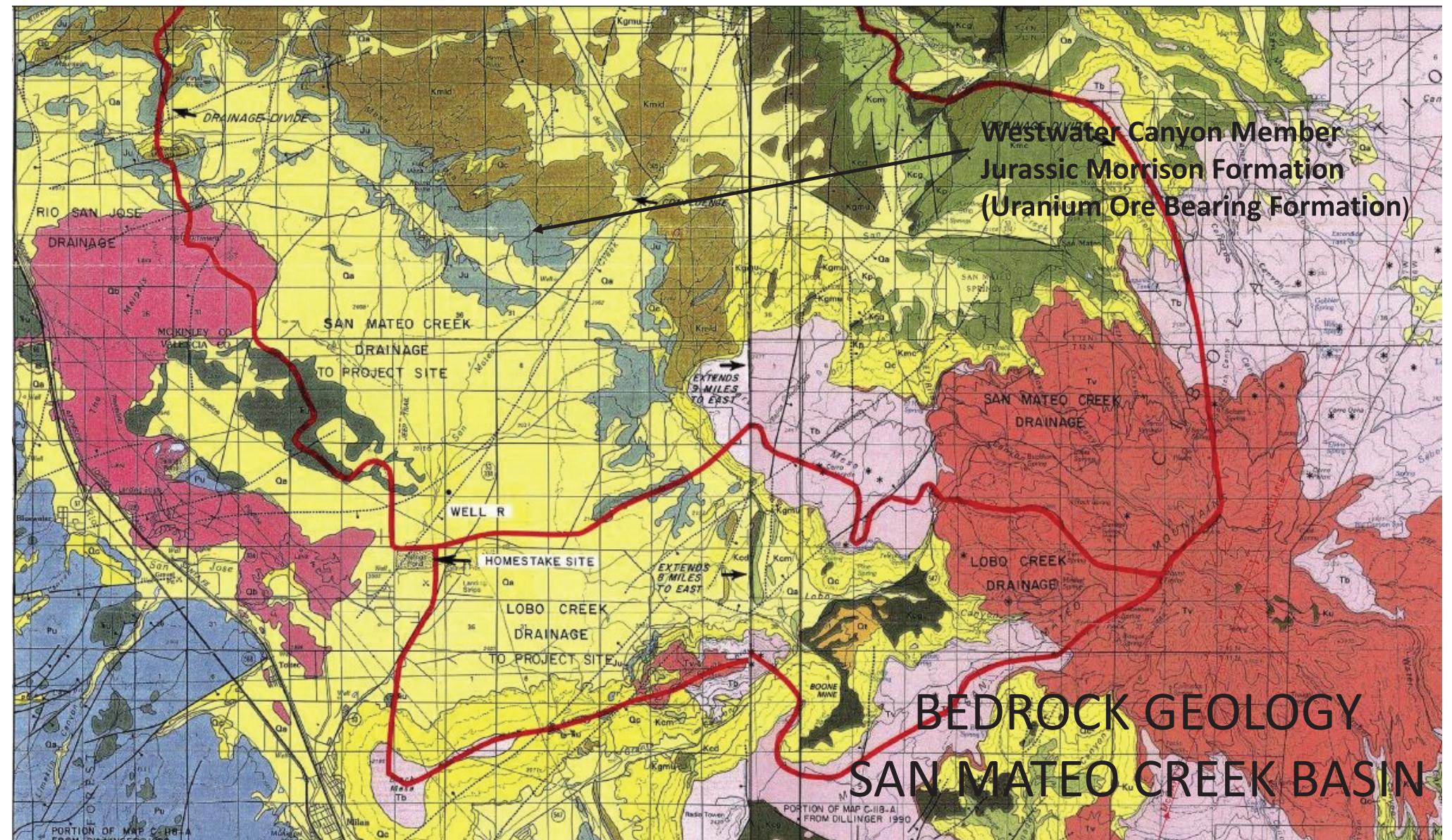
From Homestake 2013 Annual Report



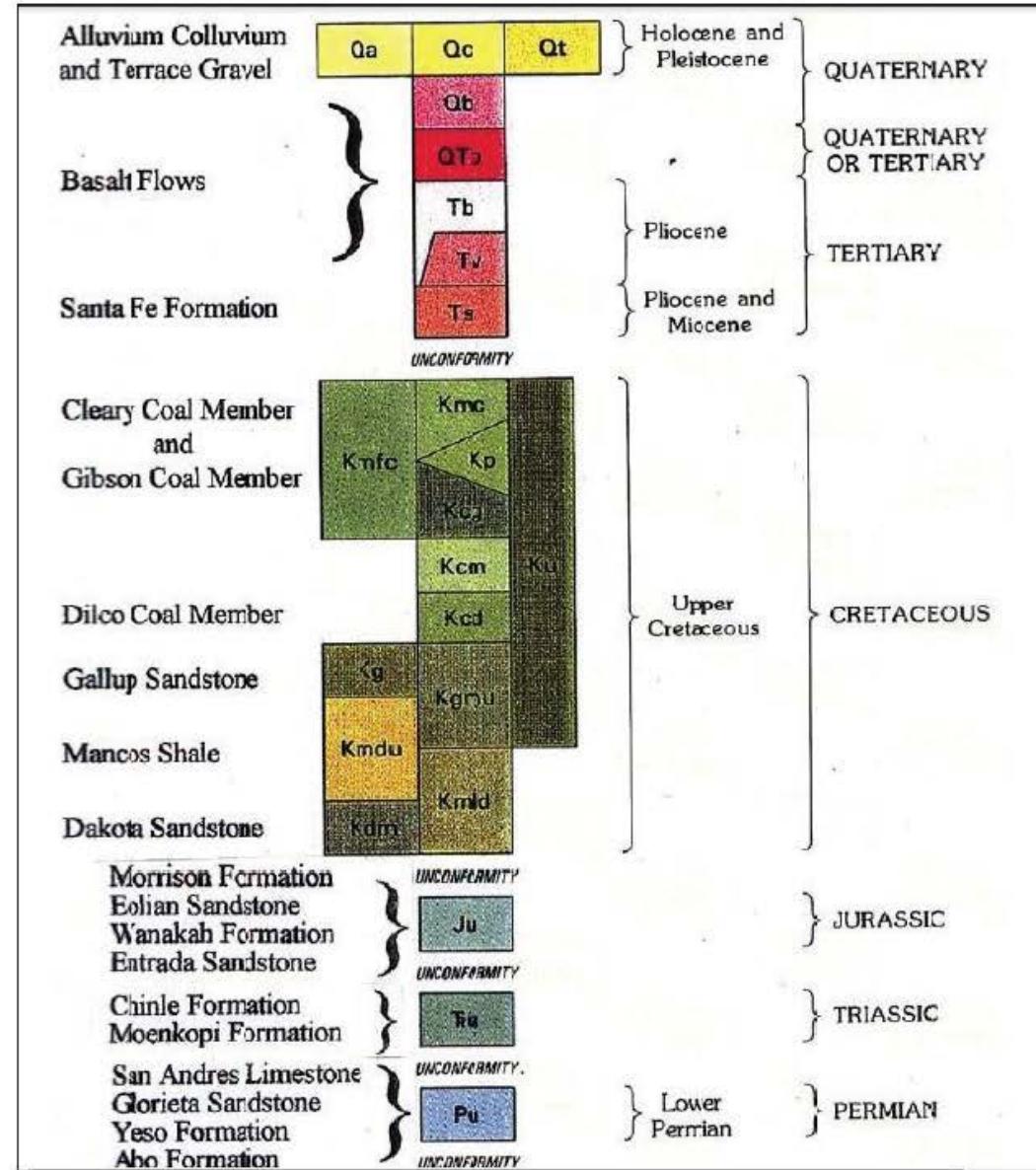
NEAR UPGRAIDENT AND FAR UPGRAIDENT BACKGROUND WELL CHEMISTRY DATA



From Homestake 2013 Annual Report
And 2003 Statistical Evaluation Report



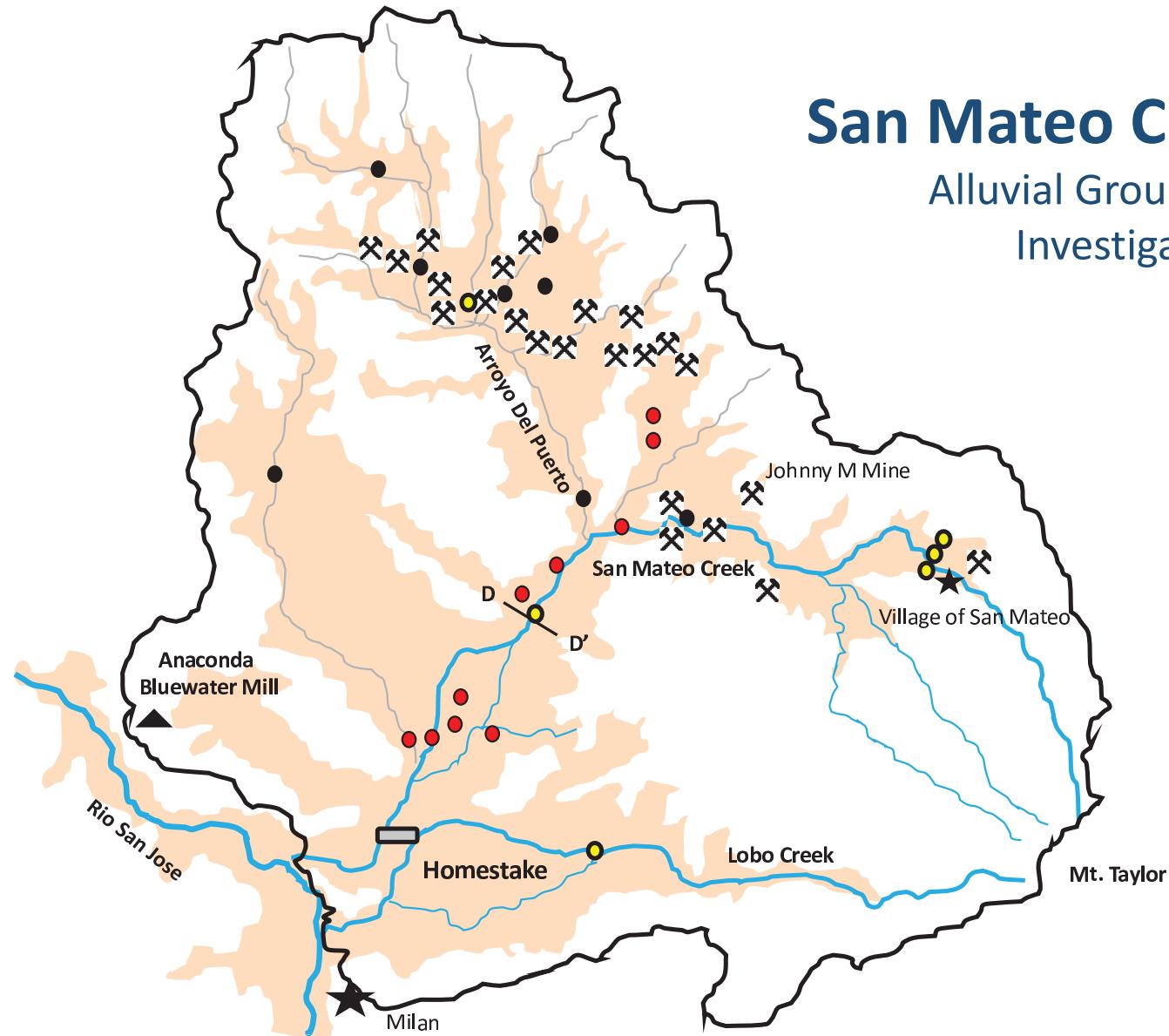
LEGEND TO BEDROCK GEOLOGY MAP



San Mateo Creek Basin

Alluvial Ground Water Investigation

- New Monitoring Well
- Existing Monitoring Well
- Dry Borehole
- Wet Mine
- Alluvium (from USGS)



CROSS SECTION D-D'
CENTRAL SAN MATEO CREEK BASIN AREA
Upgradient Of Homestake

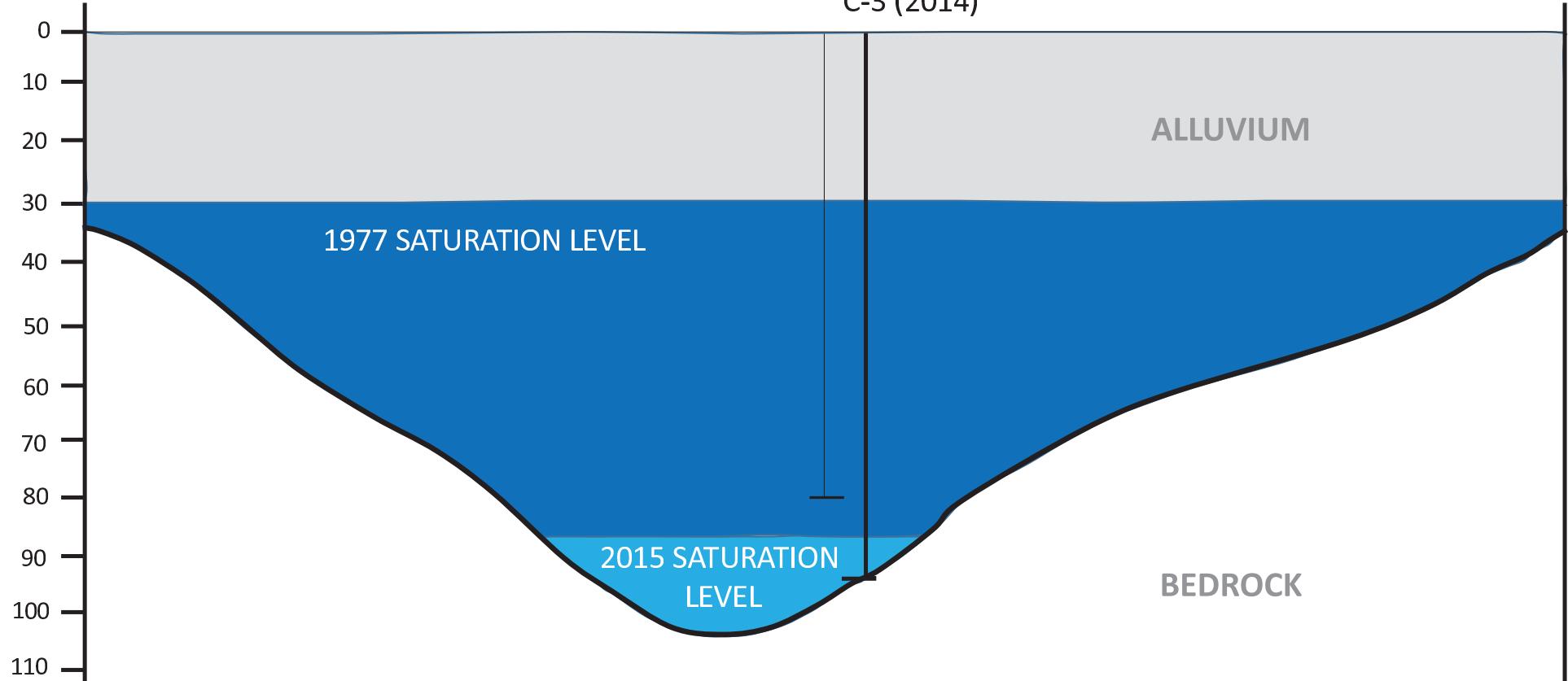
D

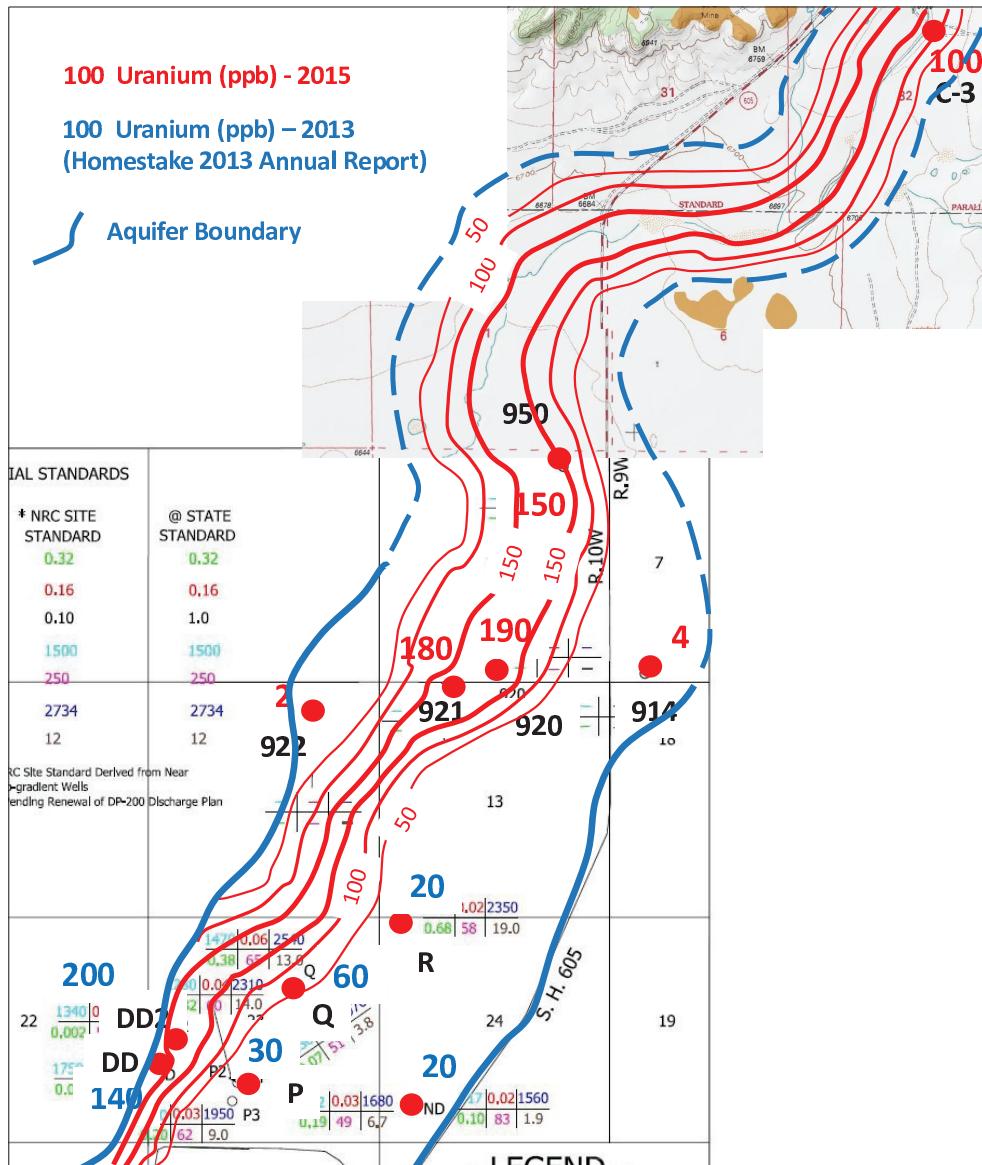
D'

West

East

Depth
(ft)

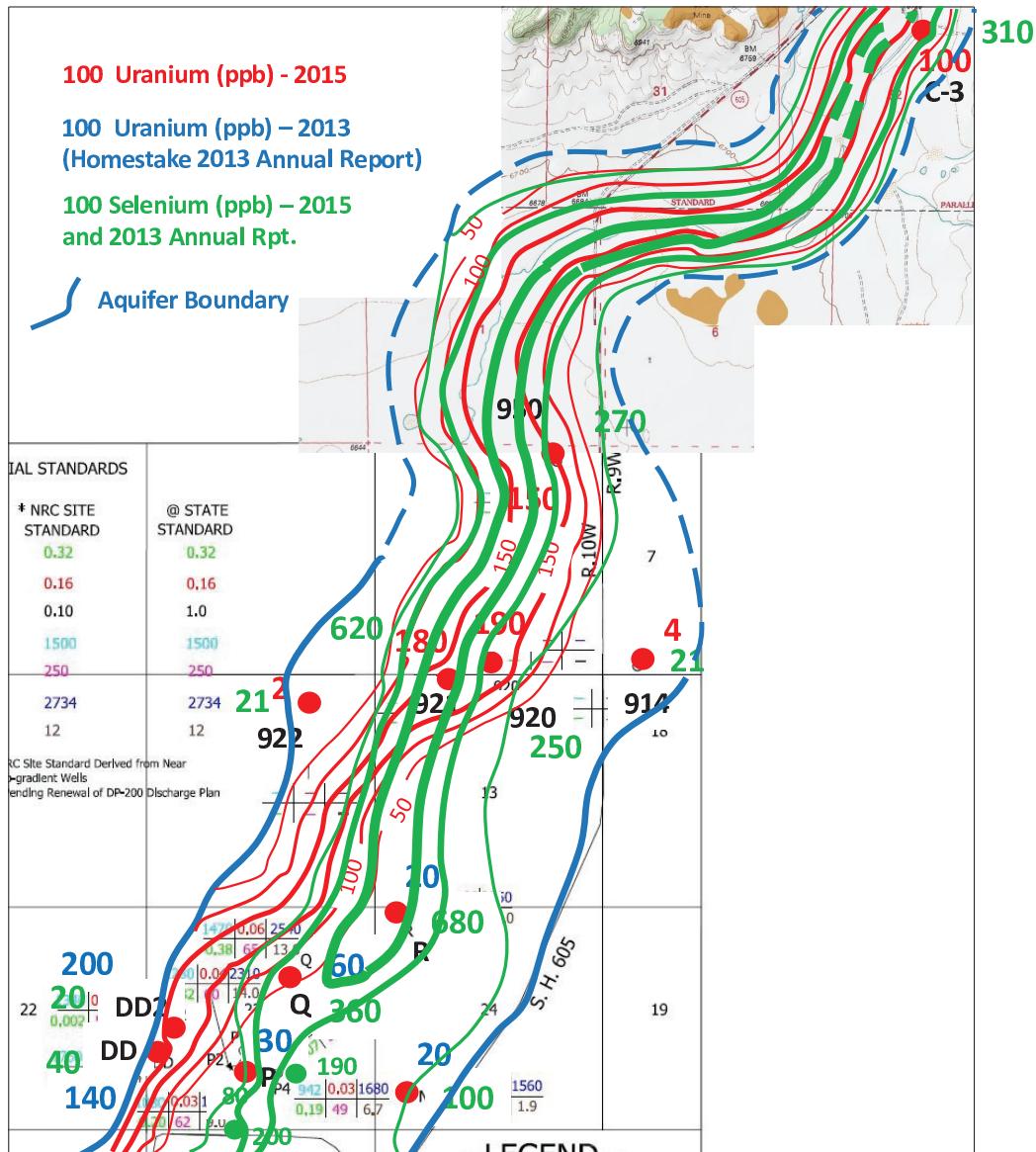




URANIUM CONCENTRATION CONTOUR MAP

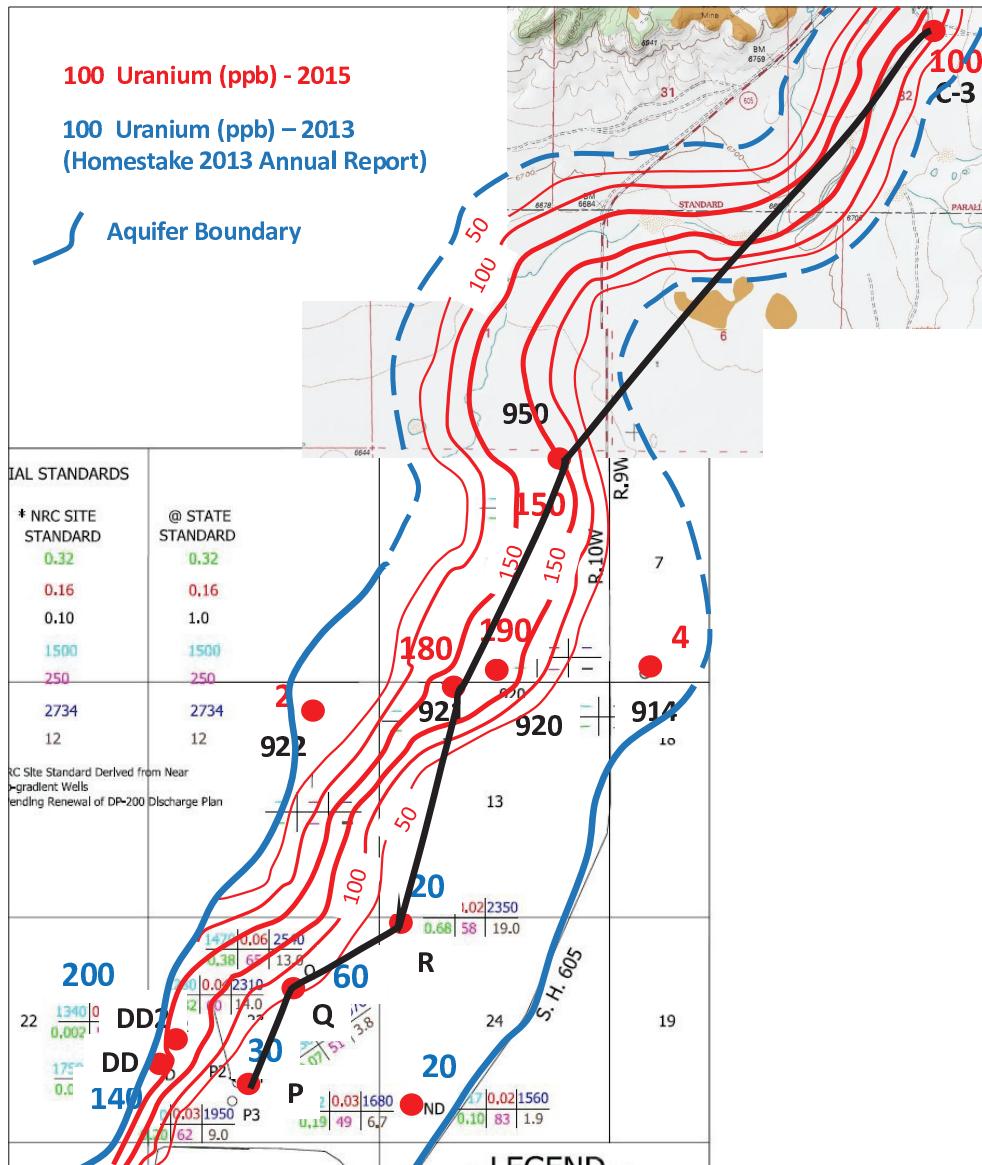
ALLUVIAL AQUIFER
NORTH OF HOMESTAKE

Base map from Homestake 2013 Annual Report
Data from EPA's San Mateo Creek ground water investigation,
Homestake 2013 Annual Report



URANIUM AND SELENIUM CONCENTRATION CONTOUR MAP

ALLUVIAL AQUIFER
NORTH OF HOMESTAKE



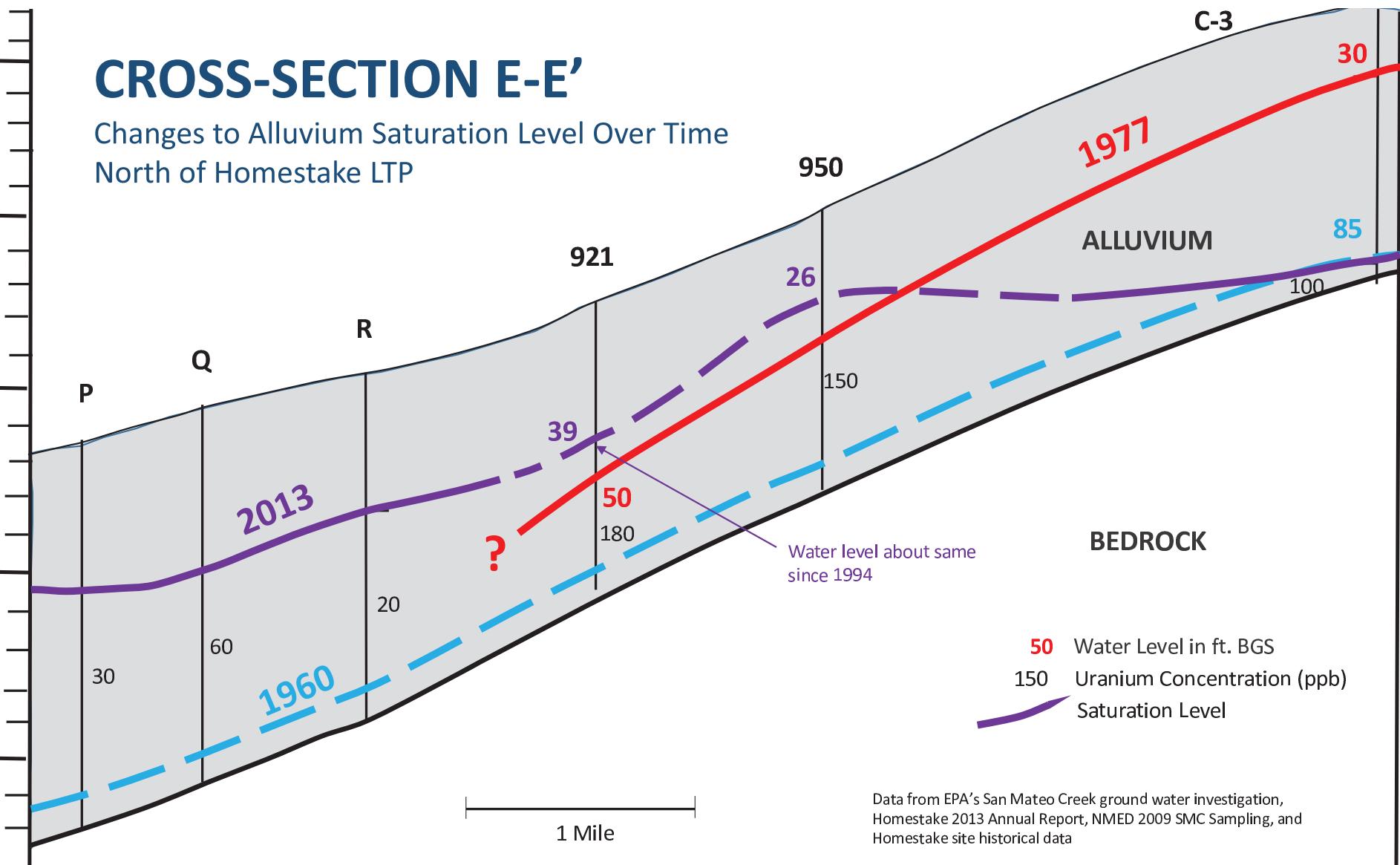
CROSS-SECTION E-E' TRANSECT

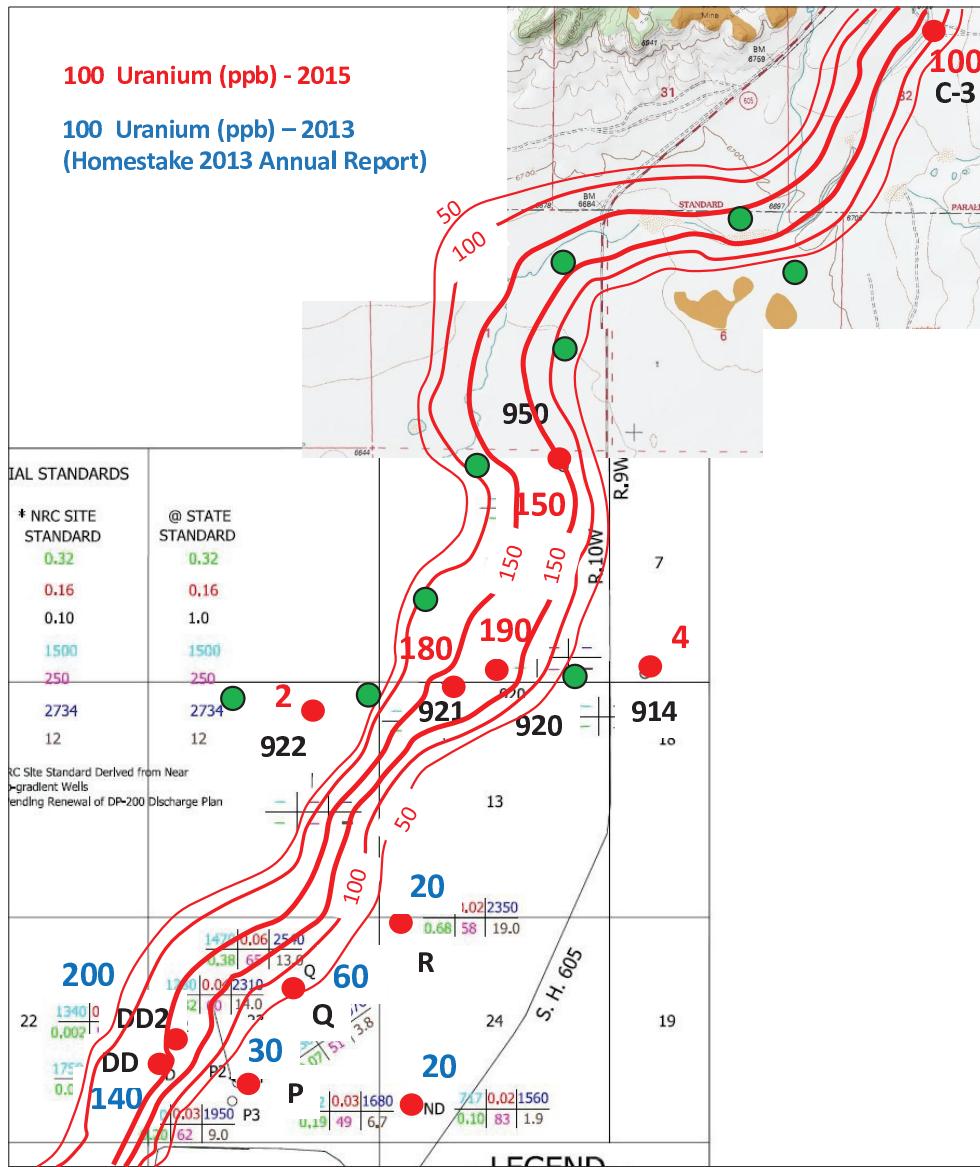
ALLUVIAL AQUIFER
NORTH OF HOMESTAKE

Base map from Homestake 2013 Annual Report
Data from EPA's San Mateo Creek ground water investigation,
Homestake 2013 Annual Report

CROSS-SECTION E-E'

Changes to Alluvium Saturation Level Over Time
North of Homestake LTP





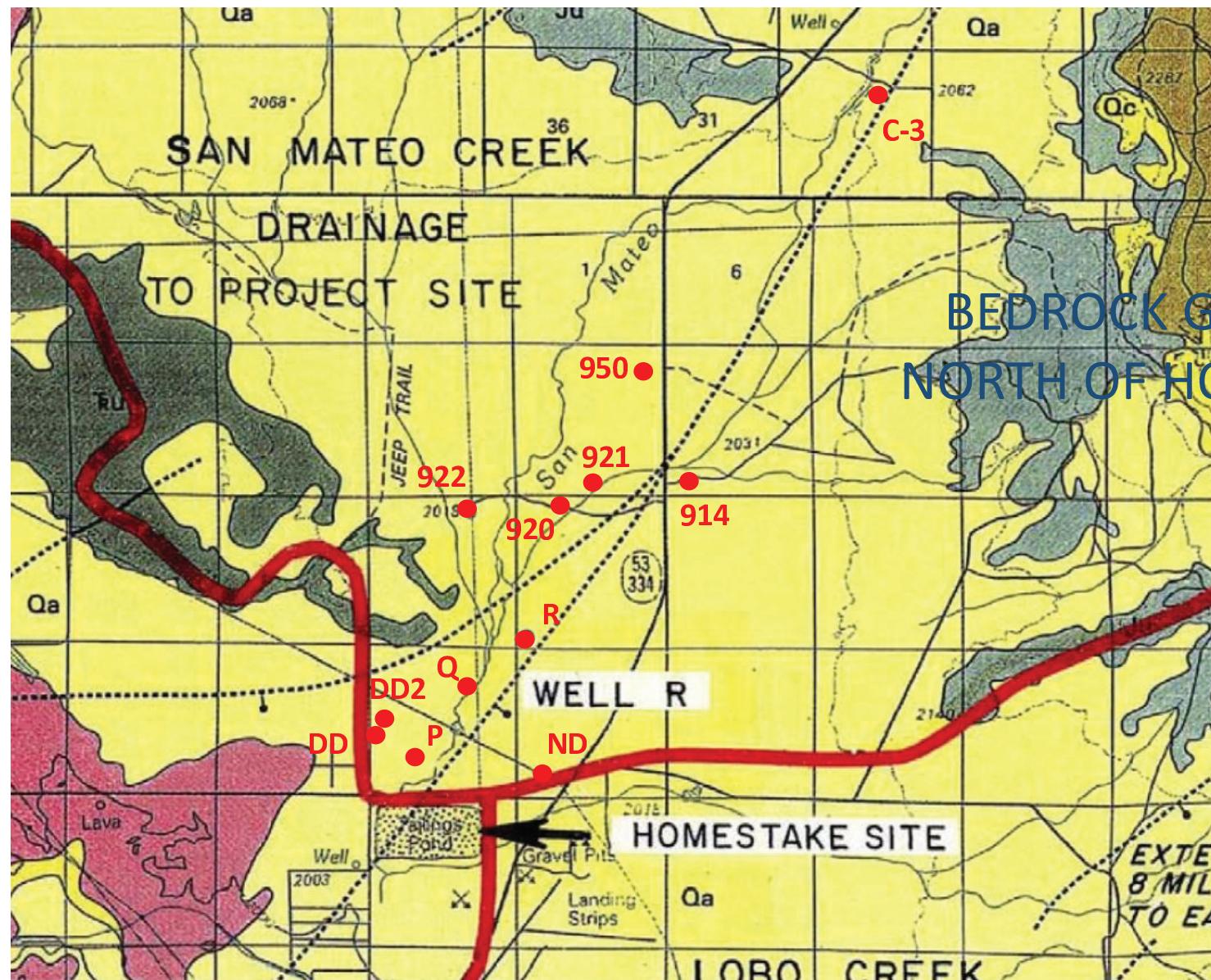
PLANNED EPA ALLUVIAL MONITORING WELLS NORTH OF HOMESTAKE 2015

San Mateo Creek Basin
Ground Water Investigation

● Planned Alluvial Monitoring Well

Base map from Homestake 2013 Annual Report
Data from EPA's San Mateo Creek ground water investigation,
Homestake 2013 Annual Report

BEDROCK GEOLOGY NORTH OF HOMESTAKE



CHINLE AQUIFERS

BACKGROUND WATER QUALITY ASSESSMENT

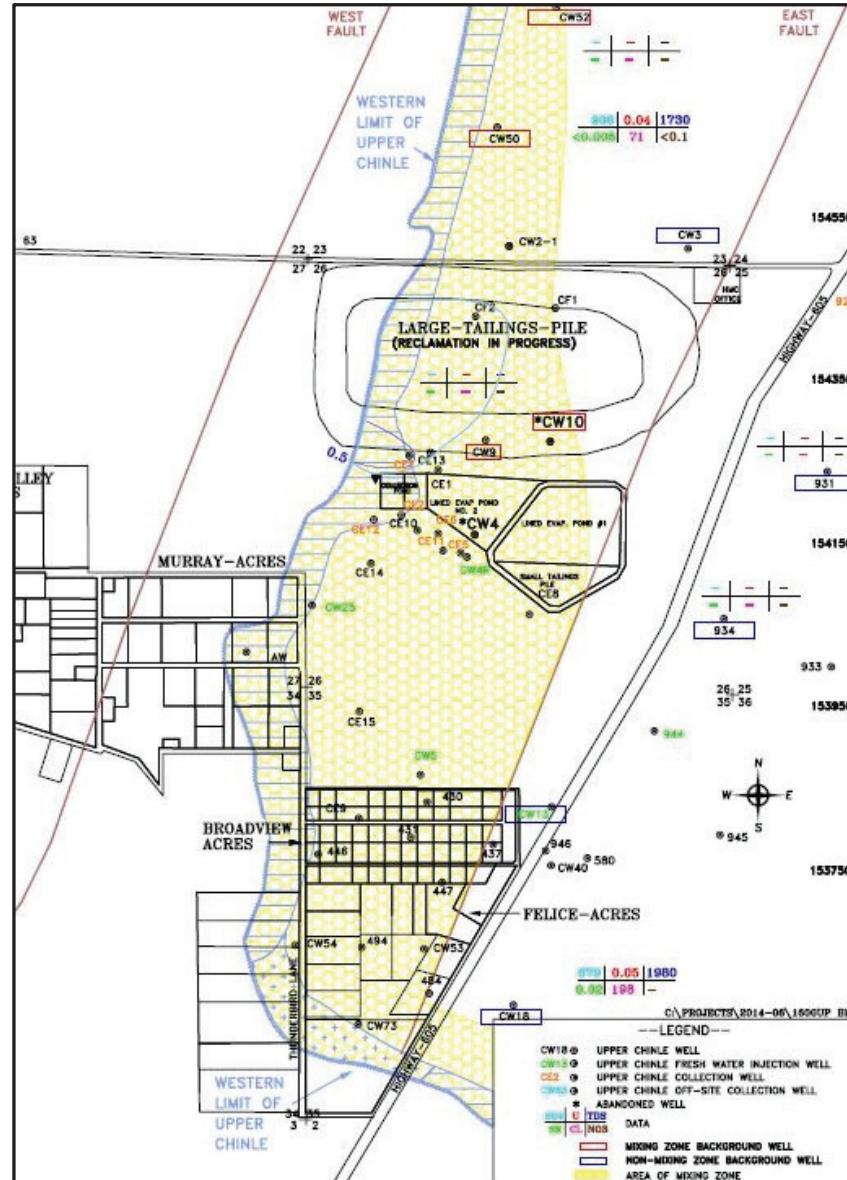
UPPER CHINLE

Mixing Zone wells

- CW-50 and CW-52 are in good locations
- CW-9 and CW-10 not in best locations but water appears to be of better quality

Non-Mixing Zone Wells

- 931 and 934 are in good locations
- Why are Uranium levels in CW-3, CW-13 and CW-18 are so high?



Data Availability

- CW-50 and CW-52 – 2003 to Present
- CW-9 – 1987 to 2000
- CW-10 – 1987 to 1994
- 931 – 1982 to 2000
- 934 – 1982 to 2003
- CW3 – 1984 to 2001*
- CW13 and CW18 – 1994 and 1995, respectively, to 2003

* Well CW3 samples collected after 2001 were not used. The constituent concentrations are elevated due to continuous pumping at that well

Map from Homestake 2013 Annual Report

UPPER CHINLE BACKGROUND WELL DATA

	Well	Uranium (ppb)	Selenium (ppb)	Molybdenum (ppb)	Sulfate (ppm)	TDS (ppm)
Cleanup Standards (MZ)		180	140	100	1750	3140
Mixing Zone	CW-50*	41-42	<5-7	<30		
	CW-52*	9-41	17-28	<30		
	CW-9	<8.5-55	<10-25	<30-110		
	CW-10	12-50	<1-7	<10-20		
Cleanup Standards (NMZ)		90	60	100	914	2010
Non-Mixing Zone	CW-3	02-76	05-68	10-50	566-1,050	920-2,130
	CW-13	45-96	36-244	<30		
	CW-18	16-148	<10-129	<30-50		
	931	04-50 (144?)	05-30	10-110 (420)	608-779	1,290-2,160
	934	08-93 (361)	05-63	10-230	620-821	1,549-1,930

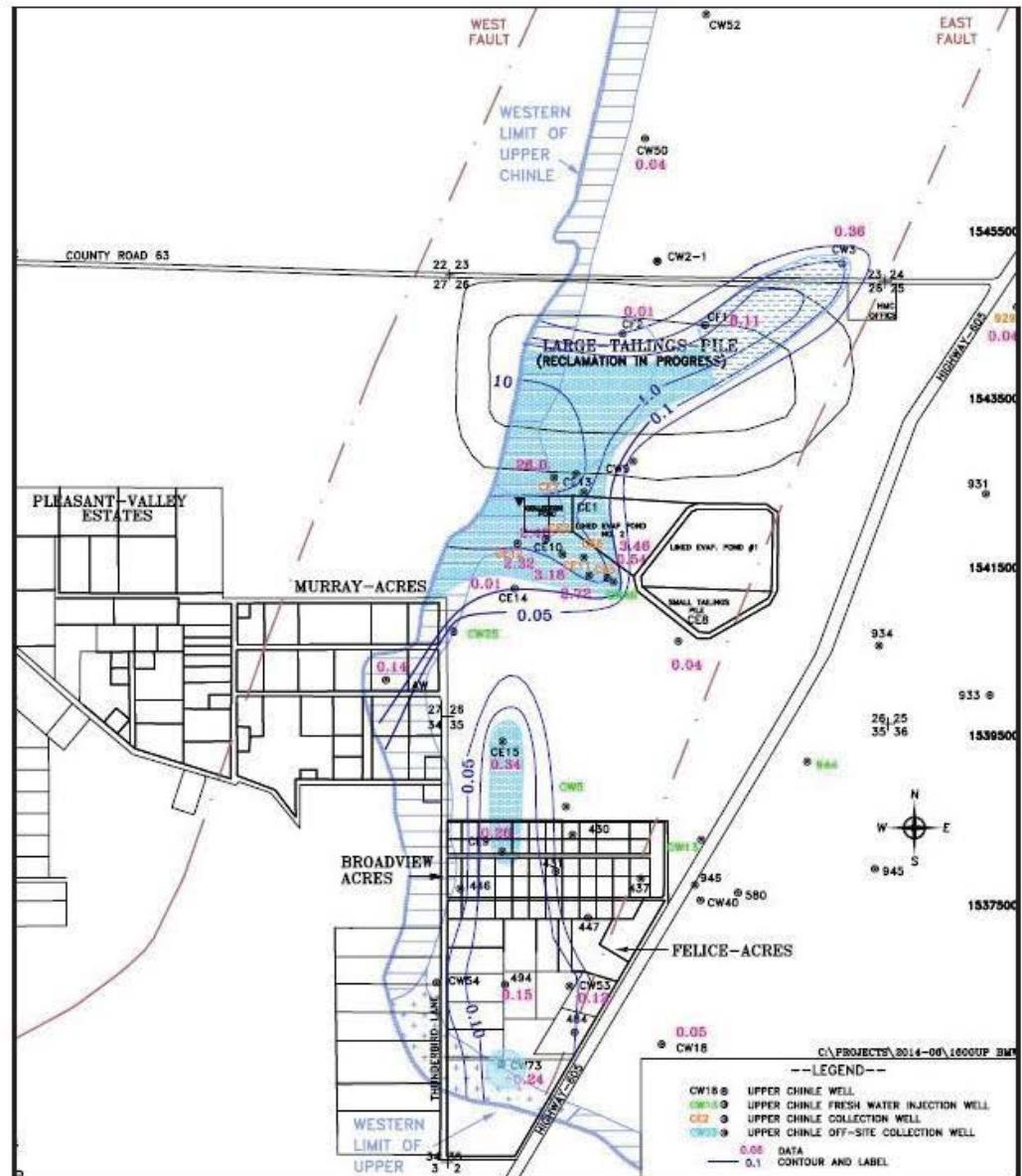
*Only two sampling events data available

Data from Homestake 2003 Statistical Evaluation Report

URANIUM ISOCONCENTRATION CONTOUR MAP

Upper Chinle

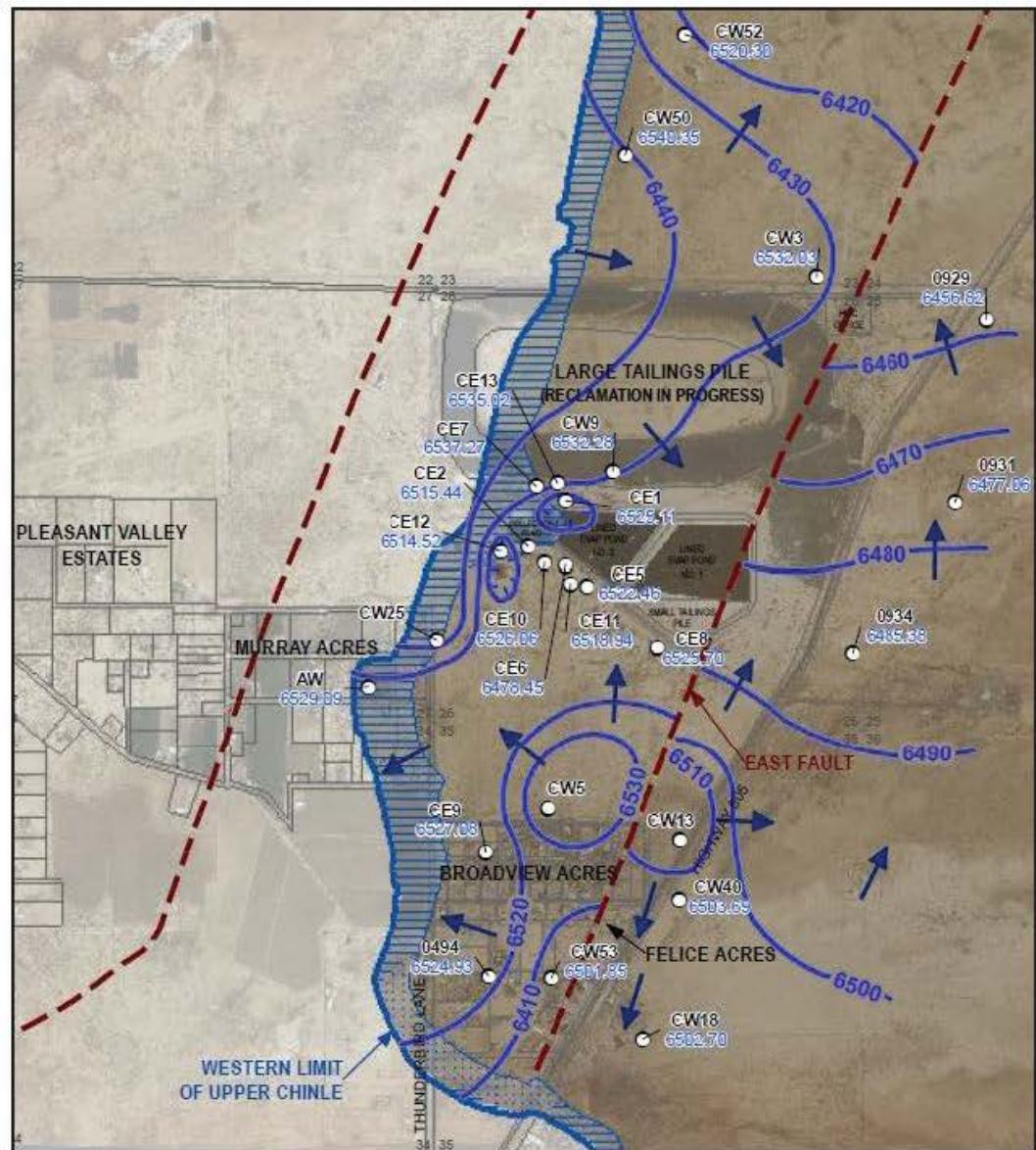
Homestake 2013 Annual Report



GROUND WATER FLOW DIRECTION

Upper Chinle

Homestake CAP



MIDDLE CHINLE

Mixing Zone Wells

- CW-15, CW-17, CW-24, CW-35, WR25 - Reasonable

Non- Mixing Zone Wells

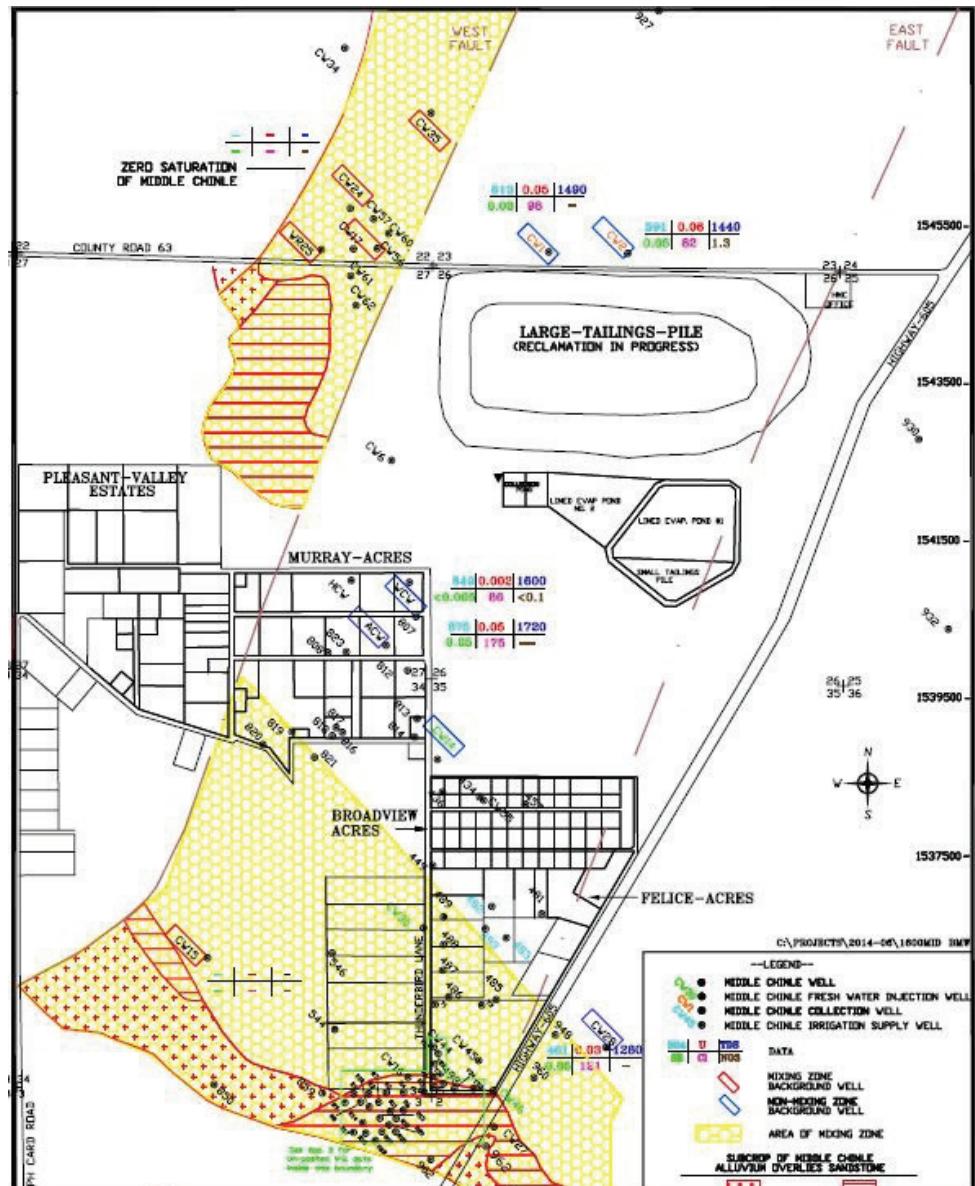
- CW1, CW2 CW-28, ACW, WCW - Reasonable
- CW-14 appears impacted by Se
- Why not use 930 or 932 for background?

Data Availability

- CW-1 and CW-2 – 1982-2003
- CW-14- 3 samples from 1995
- CW-28 – 1995-2003
- WCW- 1980-2000

Why is chemistry in Mixing Zone west of west fault used for background in east of west fault

Map from Homestake 2013 Annual Report



MIDDLE CHINLE BACKGROUND WELL DATA

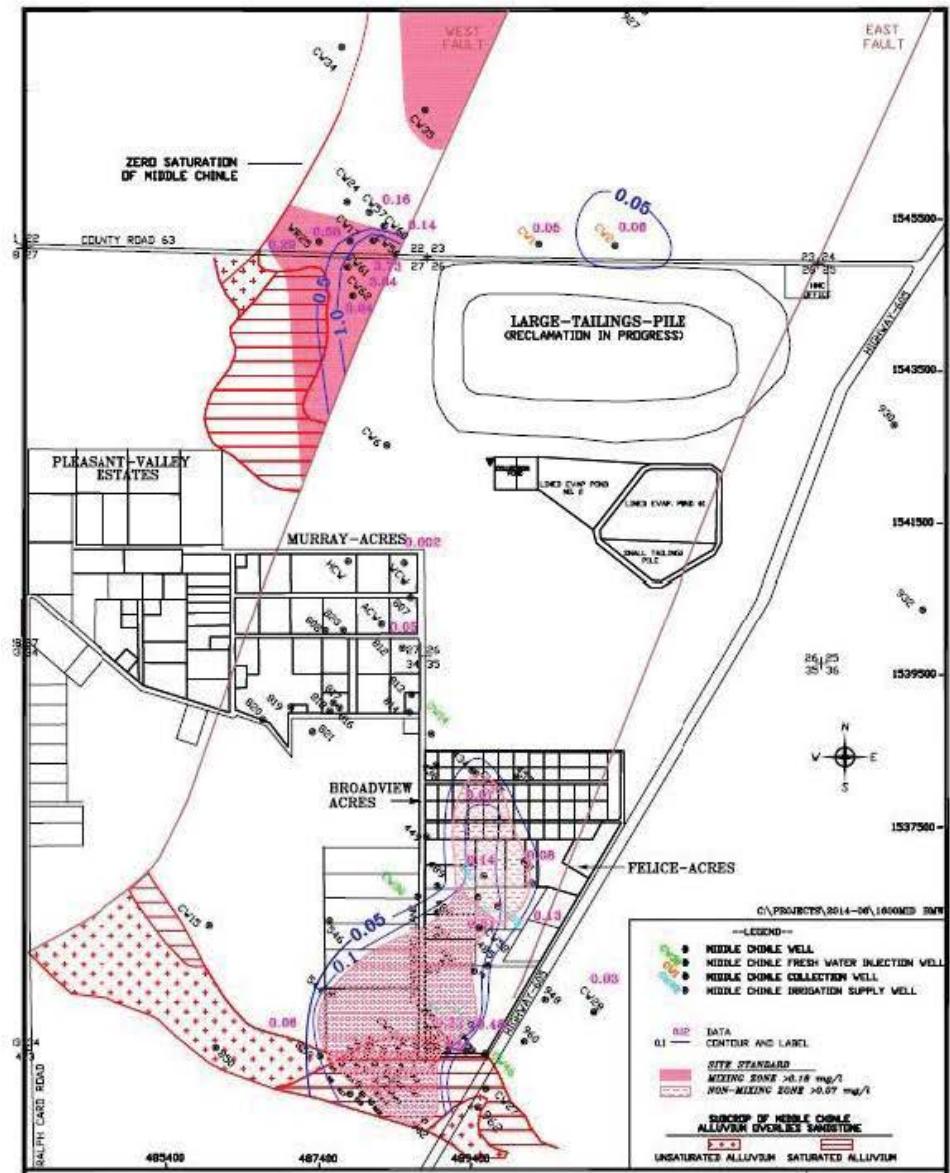
Data from Homestake 2013 Statistical Evaluation Report

	Well	Uranium	Selenium	Molybdenum	Sulfate	TDS	
Cleanup Standards (MZ)		180	140	100	1750	3140	
Mixing Zone	CW-15	15-50	11-42	<30		1446-1710	C/E Block
	CW-17	69-175	69-116	<30-70		1620-3250	Western Block
	CW-24	101-154	34-79	<30-40		3020-3160	
	CW-35	141-231	12-520	<30		1830-2370	
	WR-25						
Cleanup Standards (NMZ)		70	70	100	857	1560	
Non-Mixing Zone	CW-1	<8.5-62	11-90	<30-40		2020-2514	Central and Eastern Block
	CW-2	<8.5-69	<10-30	<10-50		860-2280	
	CW-28	11-61	16-83	<30-30		944-1410	
	ACW	<8.5-25	<10-10	<10-30		1172-1470	
	WCW	<8.5-33	<10-20	<10-30		1170-1980	
	CW-14	10-19	83-222	<30		1306-1486	

URANIUM CONCENTRATION MAP

Middle Chinle

Homestake 2013 Annual Report

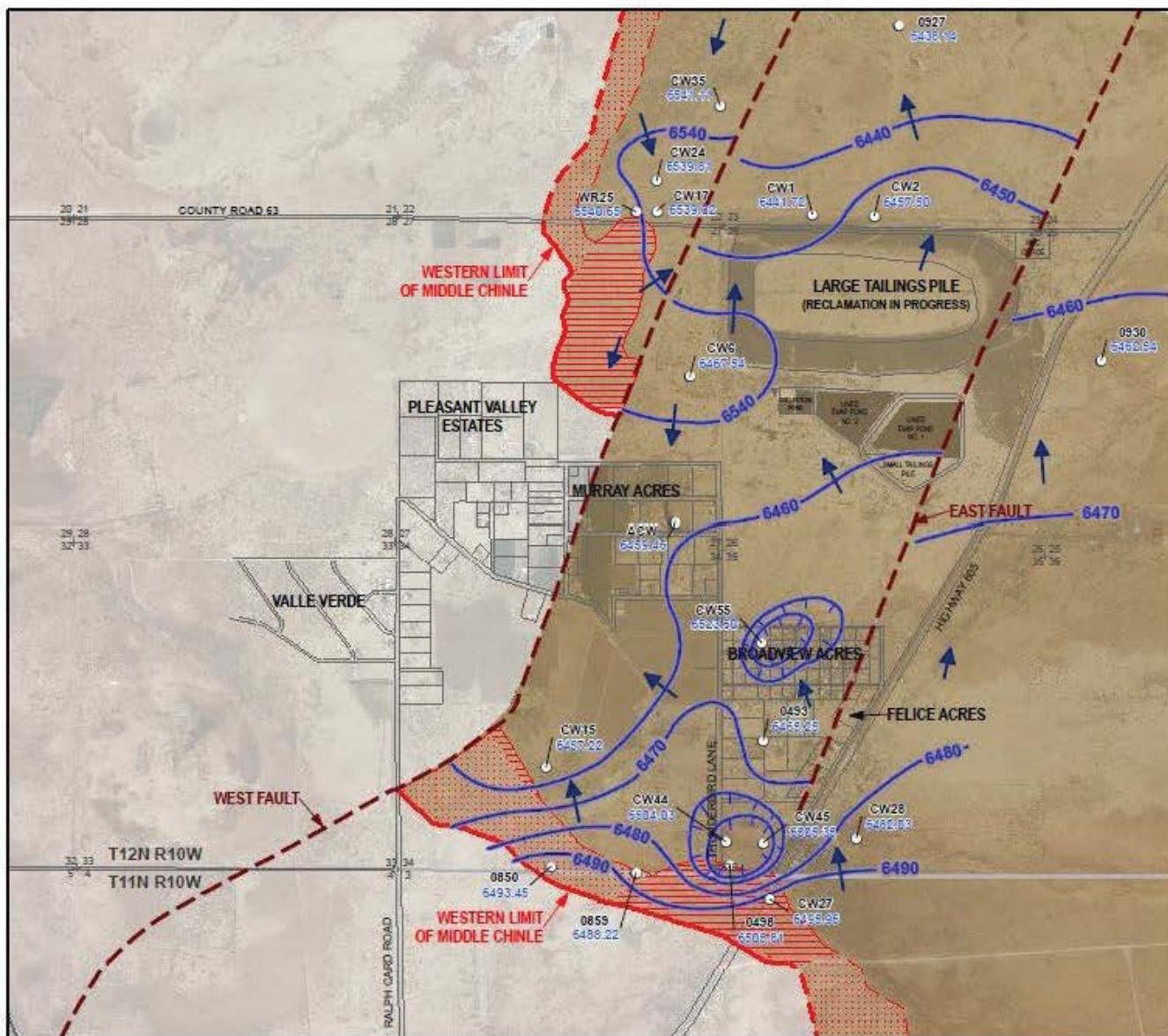


GROUND WATER FLOW MAP

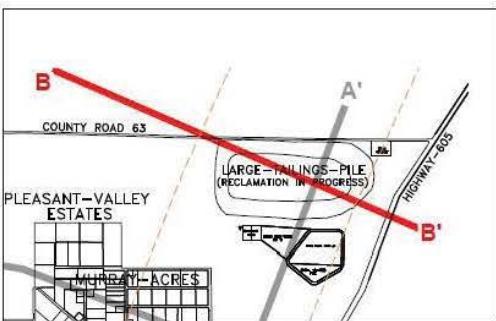
Middle Chinle

Homestake CAP

Aquifer In West Fault Block
Separated From
Central And East Block



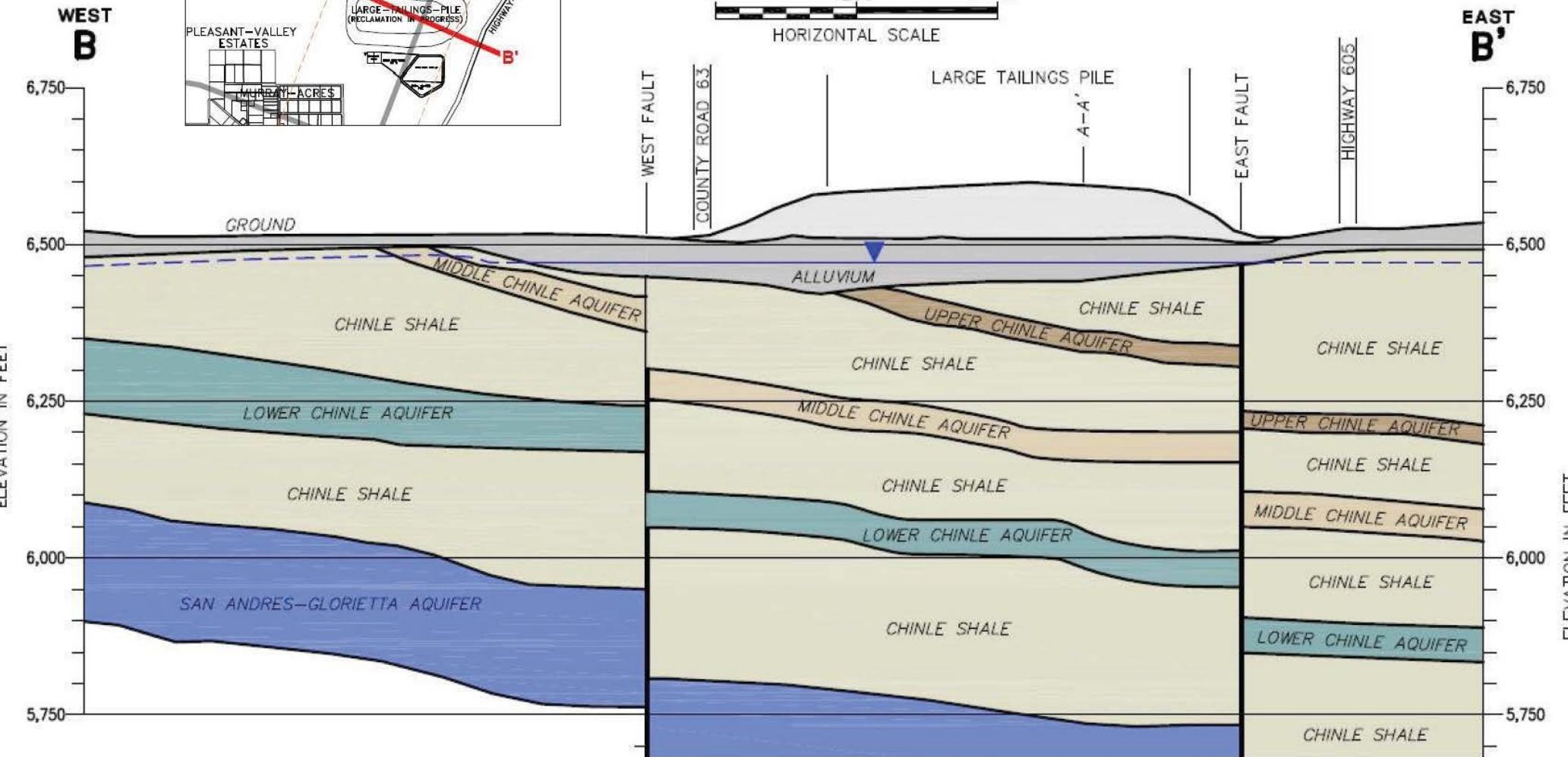
From Homestake CAP



CROSS SECTION B-B'

0 1200' 2400'

HORIZONTAL SCALE

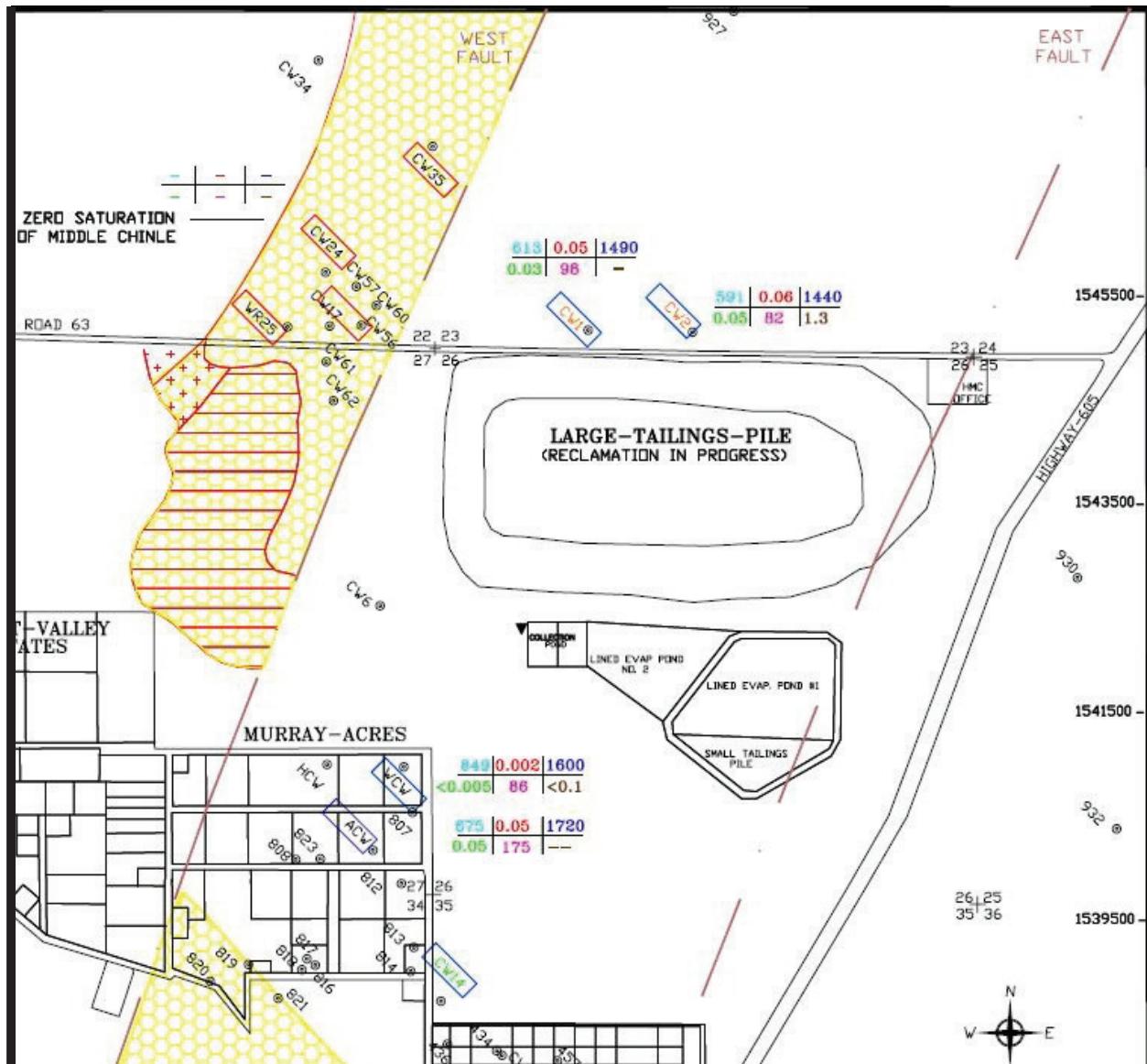


MIDDLE CHINLE

Other Issues for Mixing Zone

- No Non-Mixing Zone water quality west of West Fault?
- Downgradient Extent of Mixing Zone west of West Fault not delineated?

Map from Homestake 2013 Annual Report



LOWER CHINLE

Mixing Zone Wells

- CW-26, CW-29, CW-31, CW-32, CW-33, CW-41
- Background levels seem high

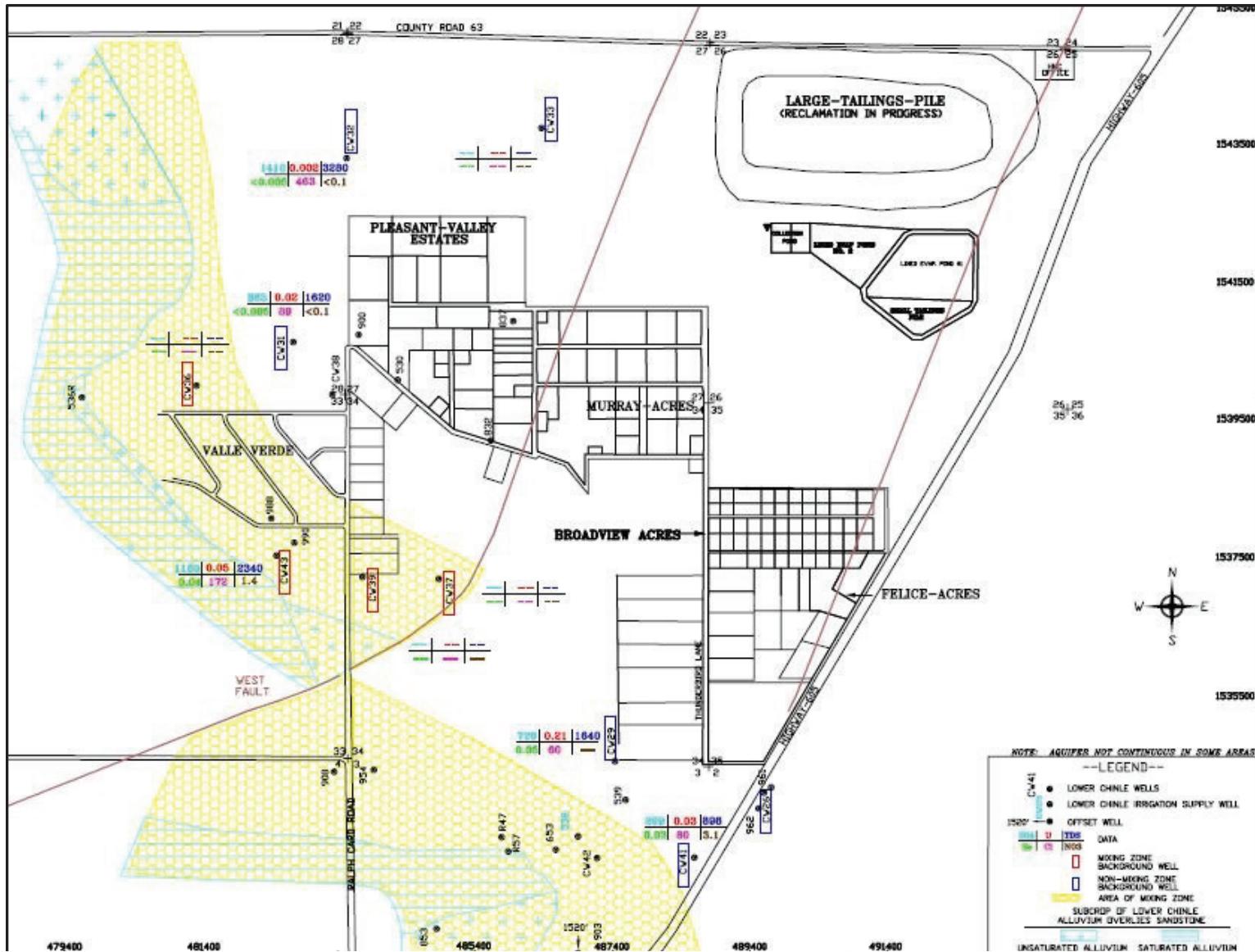
Non-Mixing Zone Wells

- Selenium in C/E Blocks seems high for Non-Mixing Zone
- Water quality is better in private wells than in background monitor wells

Data Availability

- All Wells – 1995-2002 except CW-41
- CW-41-1996-1998

Map from Homestake 2013 Annual Report



LOWER CHINLE BACKGROUND WELL DATA

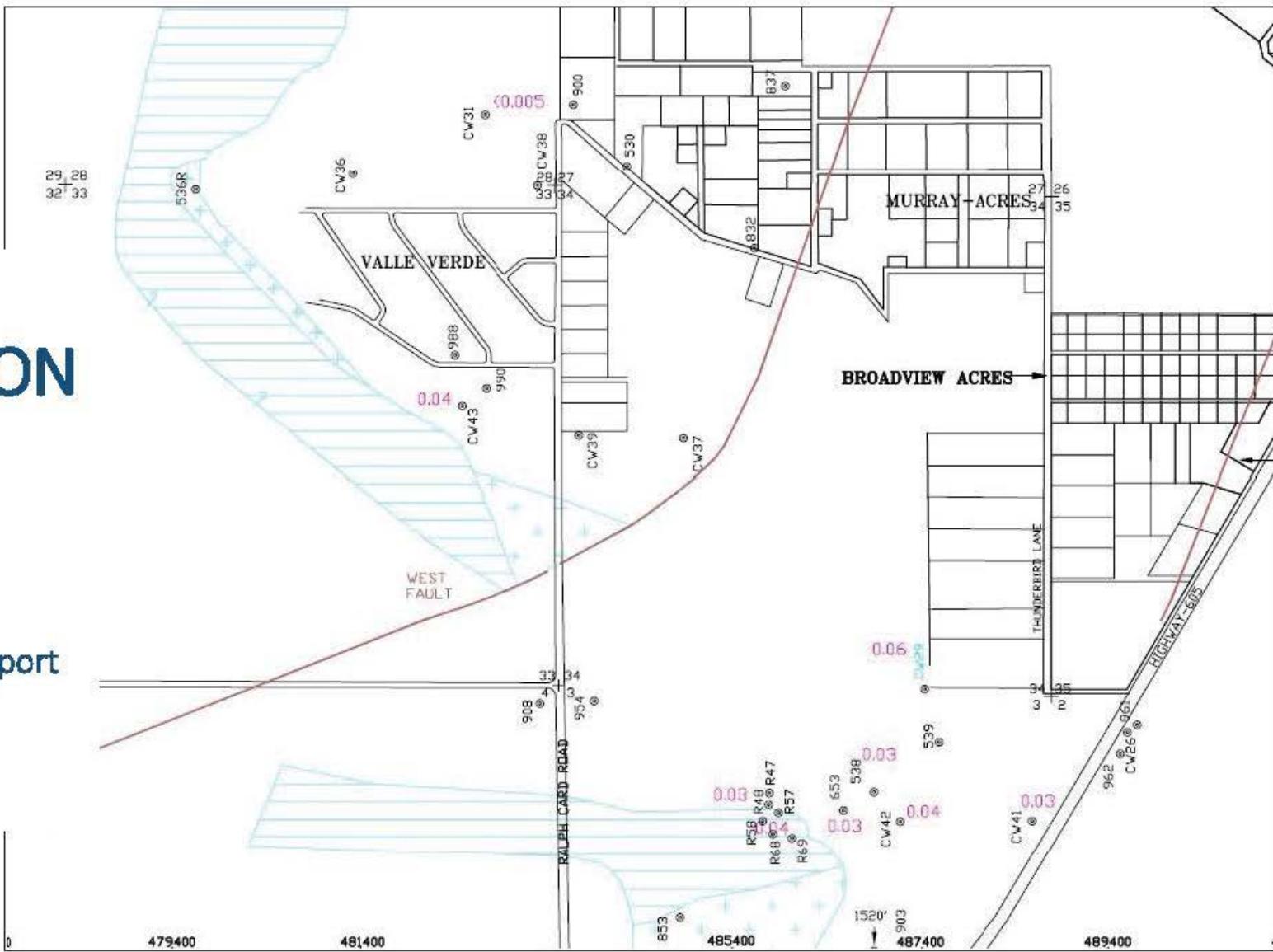
	Well	Uranium	Selenium	Molybdenum	Sulfate	TDS
Cleanup Standards (MZ)		180	140	100	1750	3140
Mixing Zone	CW-36	2-13	<5-35	<30		
	CW-37	24-32	75-96	<30		
	CW-39	17-45	31-85	<30		
	CW-43	21-33	9-25	<30		
<hr/>						
Cleanup Standards (NMZ)		30	320	100	2000	4140
Non-Mixing Zone	CW-26	16-24	192-364	<30-120		
	CW-29	9-53	<14-155	<30		
	CW-31	6-16	<5	<30		
	CW-32	6-10	<10-2570	<30		
	CW-33	<10-26	<10-14	<30		
	CW-41	13-48	8-24	<30		

Data from Homestake 2003 Statistical Evaluation Report

SELENIUM CONCENTRATION MAP

Lower Chinle

Homestake 2013 Annual Report



LOWER CHINLE - PRIVATE WELL DATA

(select wells southeast
of Felice Acres)

Well	Uranium (ppb)	Selenium (ppb)	TDS (ppm)
RW-37 (963)	15	12	700
RW-38 (572)	11	8	598
RW-42 (954)	6	2	934
RW-44 (574)	17	9	606
RW-47 (964)	16	11	658

Data from NMED Summary Report on 2005-2007 Residential Sampling

PRIVATE WELL LOCATIONS

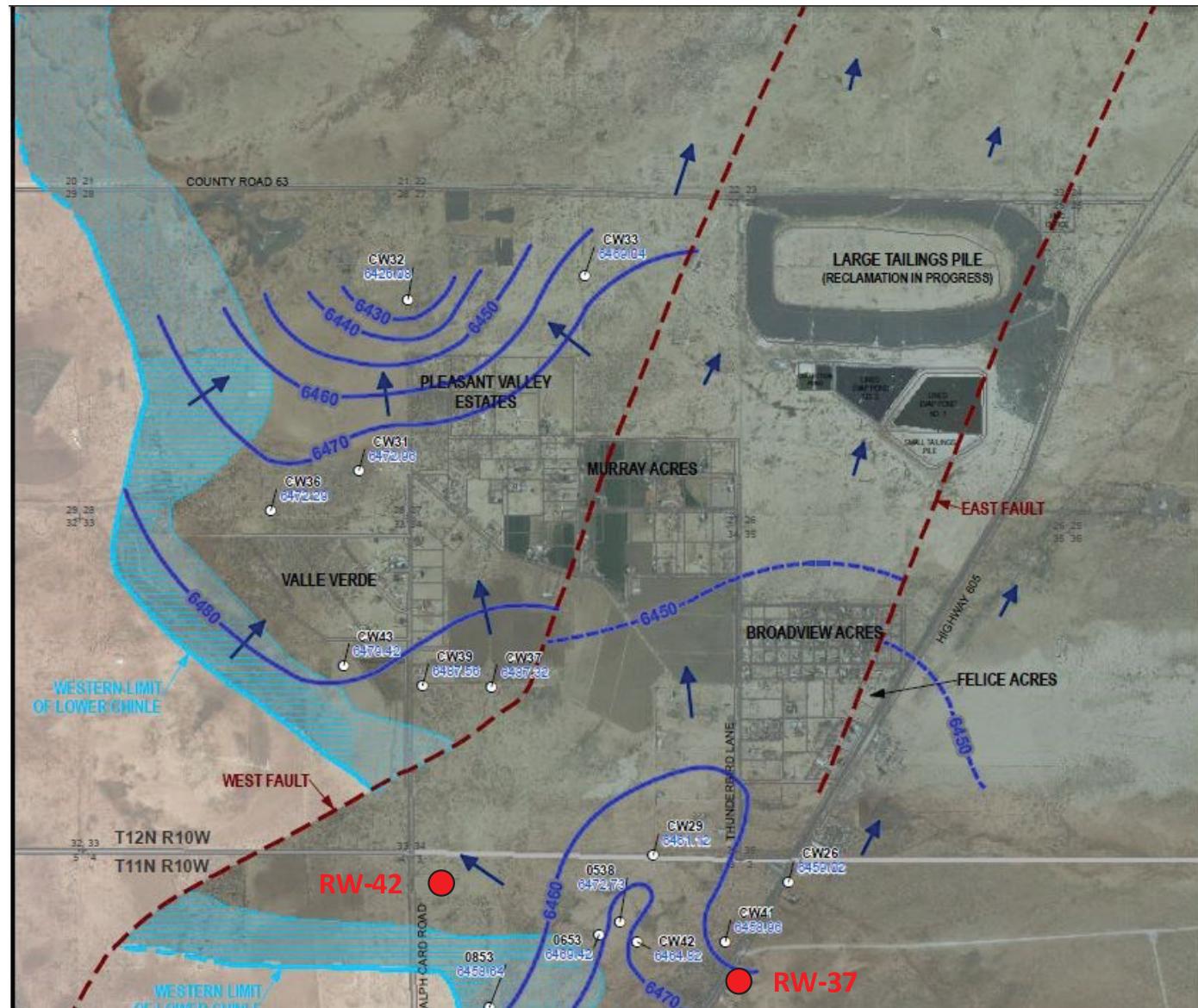


Map from NMED Summary Report on 2005-2007 Residential Sampling

GROUND WATER FLOW MAP

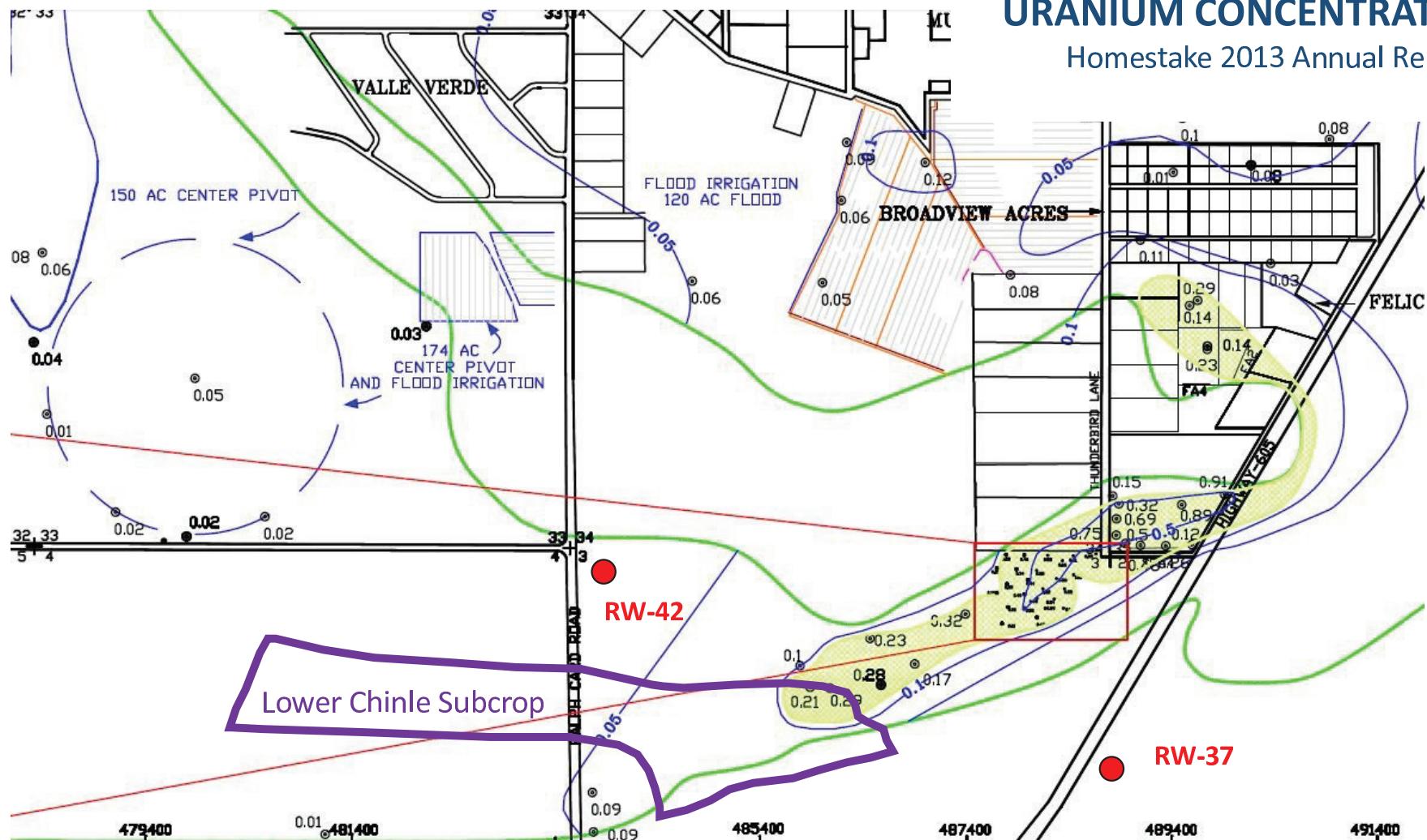
Lower Chinle

Homestake CAP



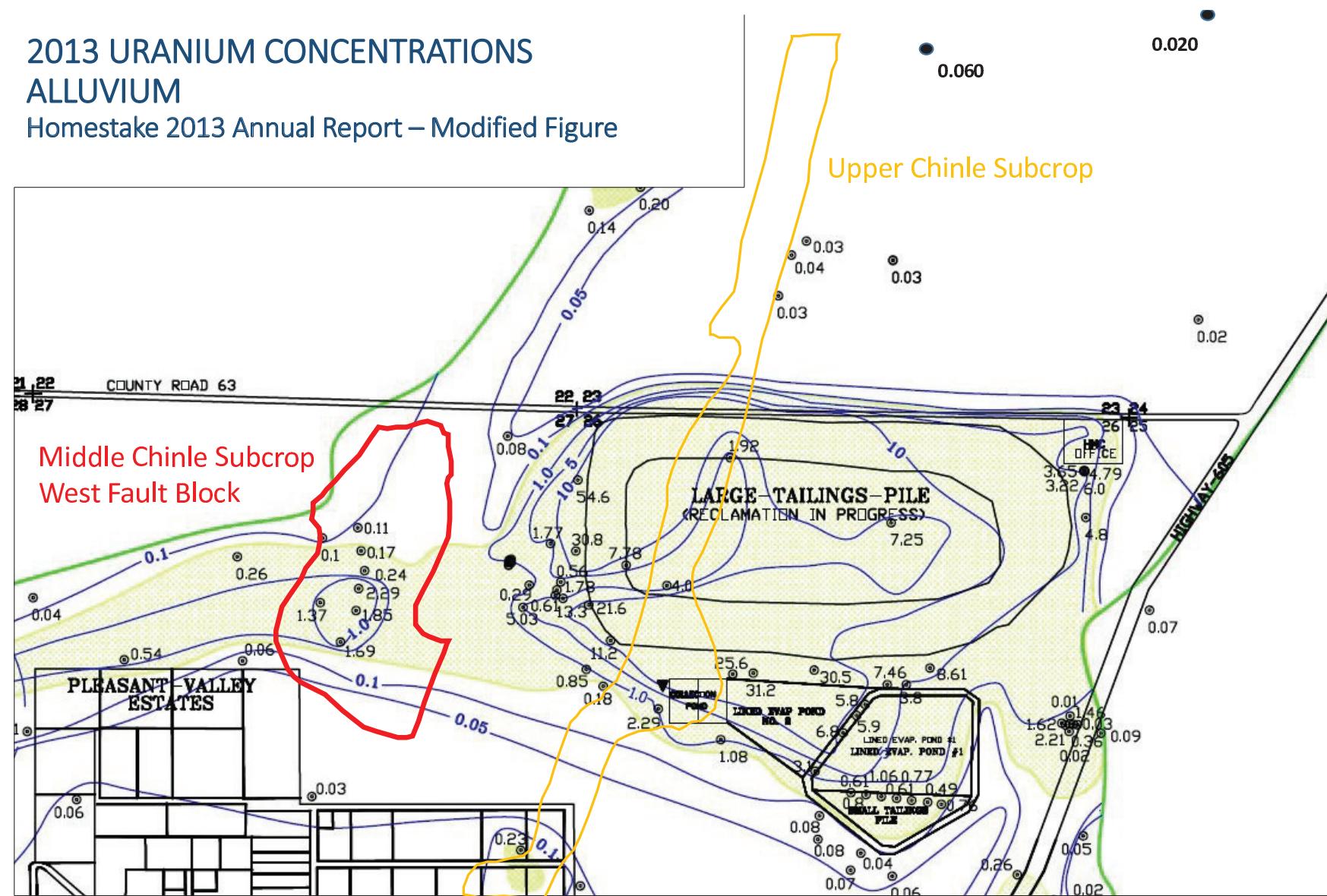
URANIUM CONCENTRATION MAP

Homestake 2013 Annual Report



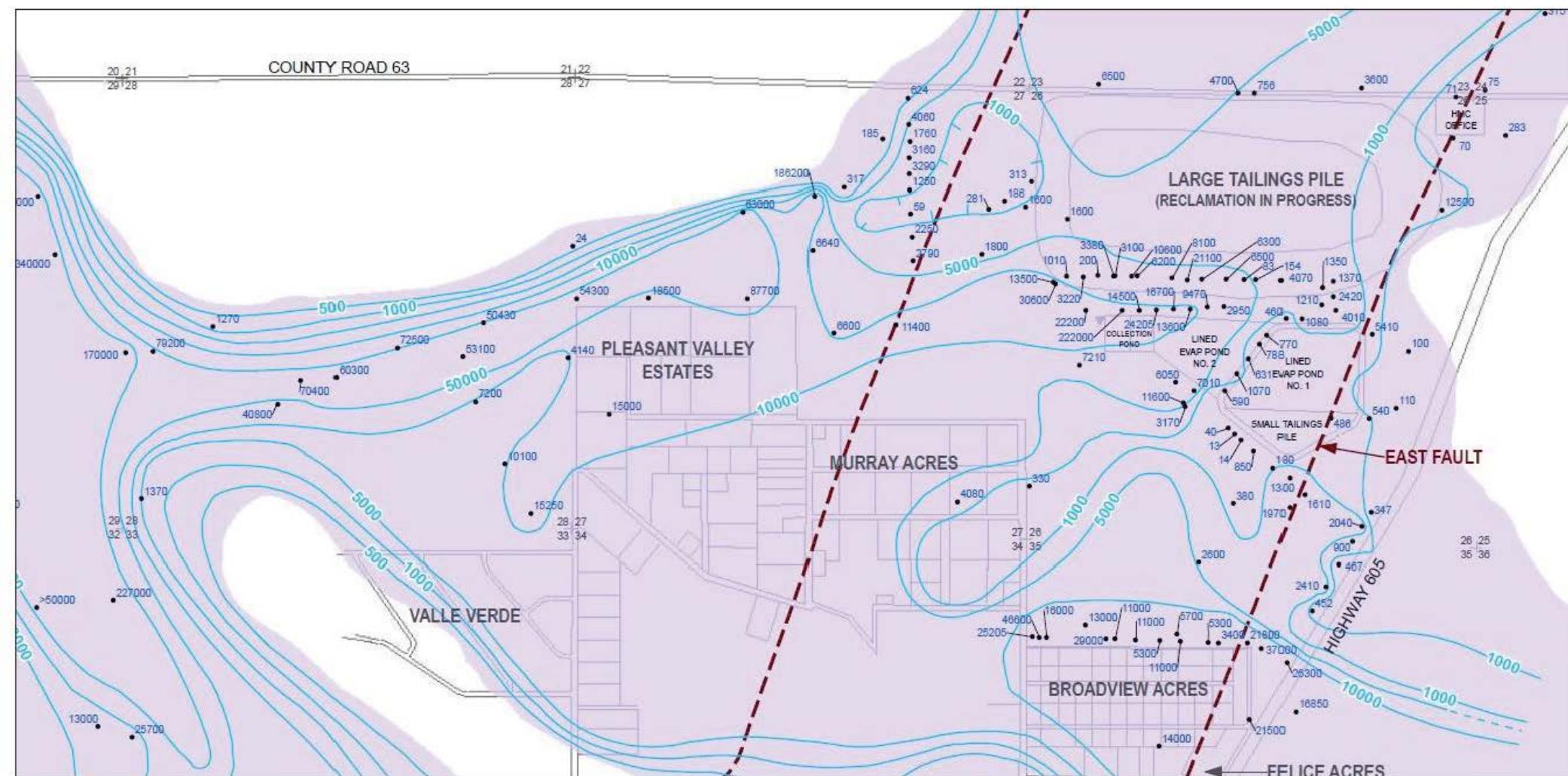
EXTRA SLIDES

2013 URANIUM CONCENTRATIONS
ALLUVIUM
Homestake 2013 Annual Report – Modified Figure



TRANSMISSIVITY – ALLUVIAL AQUIFER

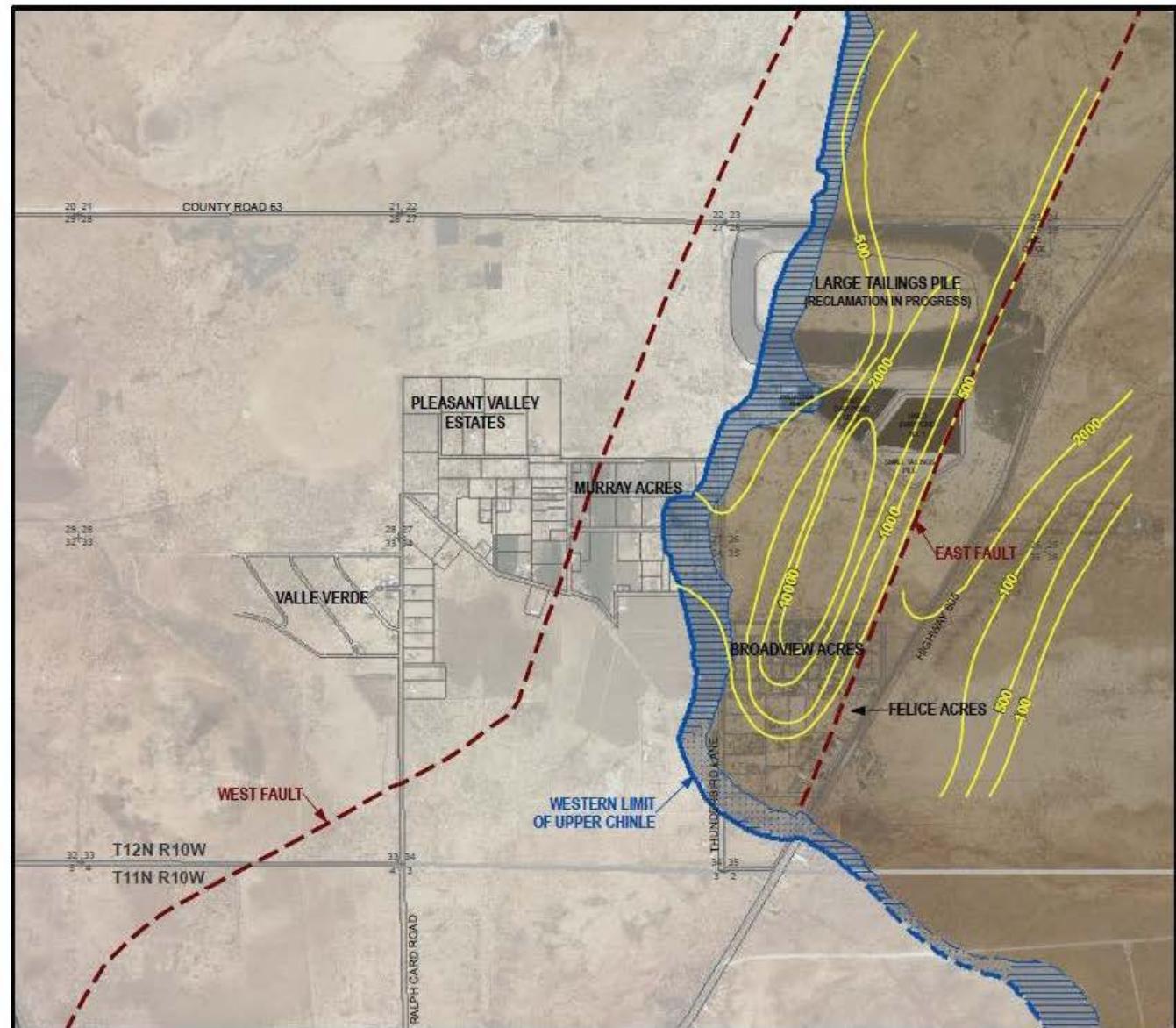
Homestake CAP



TRANSMISSIVITY

Upper Chinle

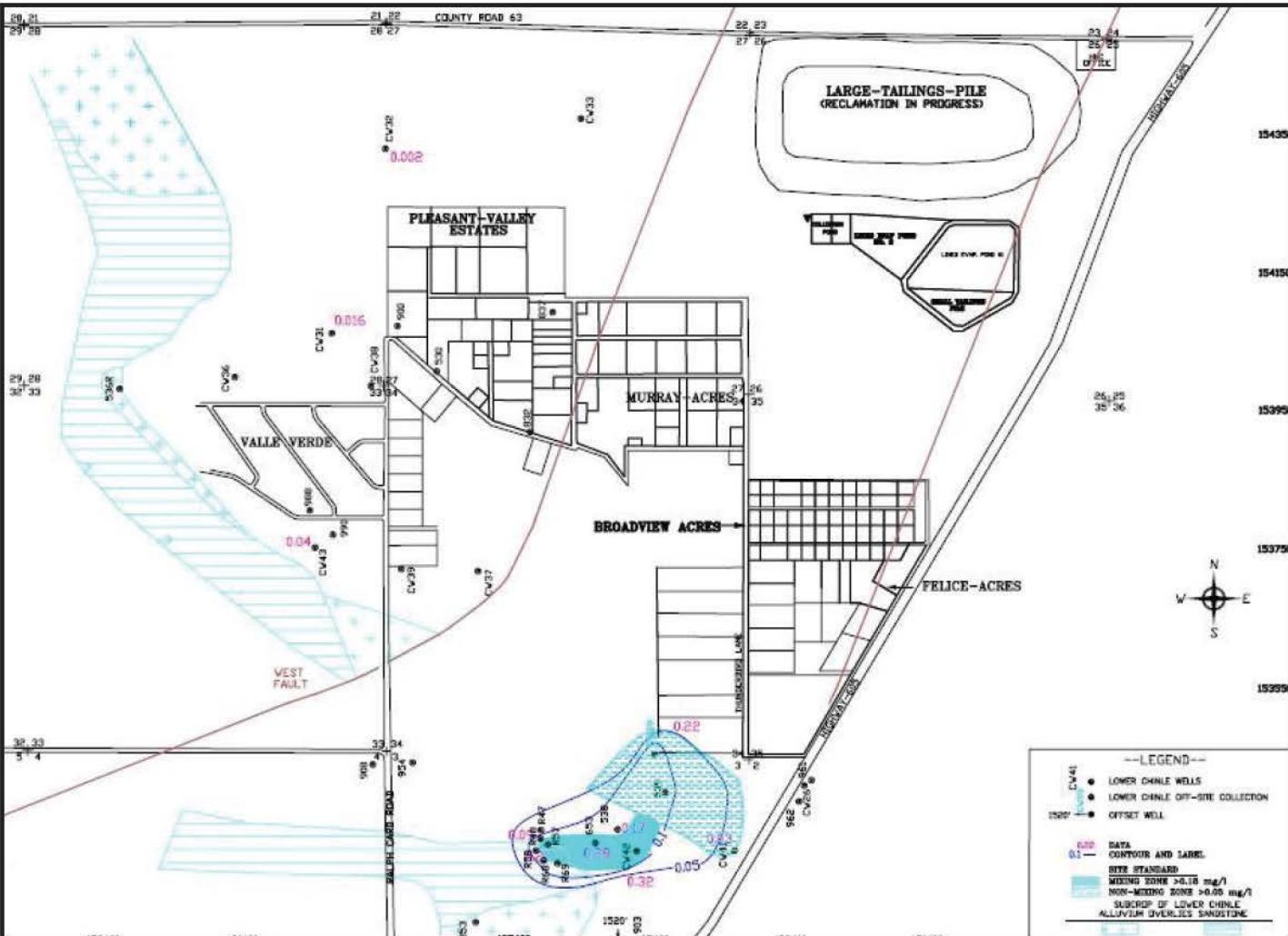
Homestake CAP



URANIUM CONCENTRATION MAP

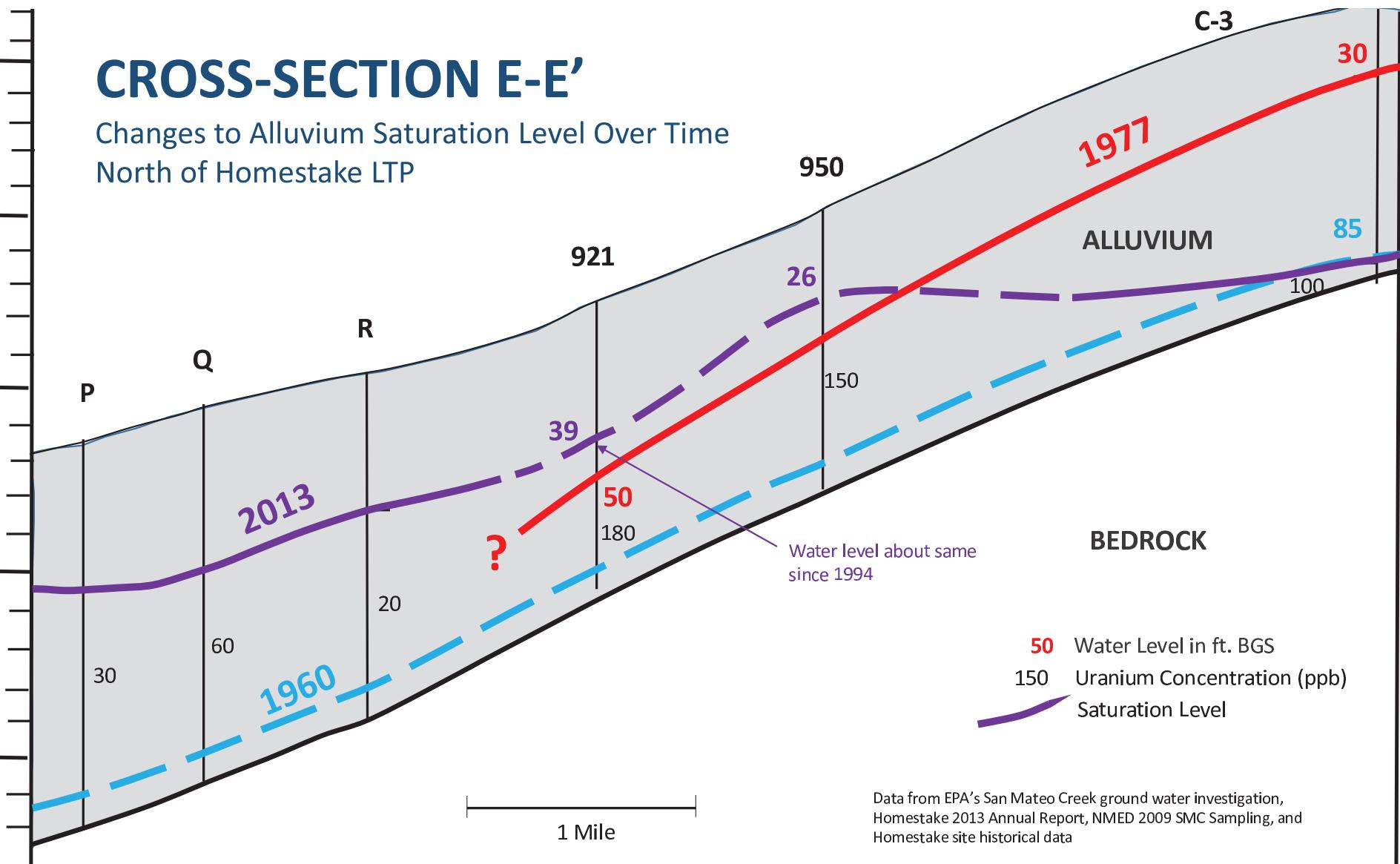
Lower Chinle

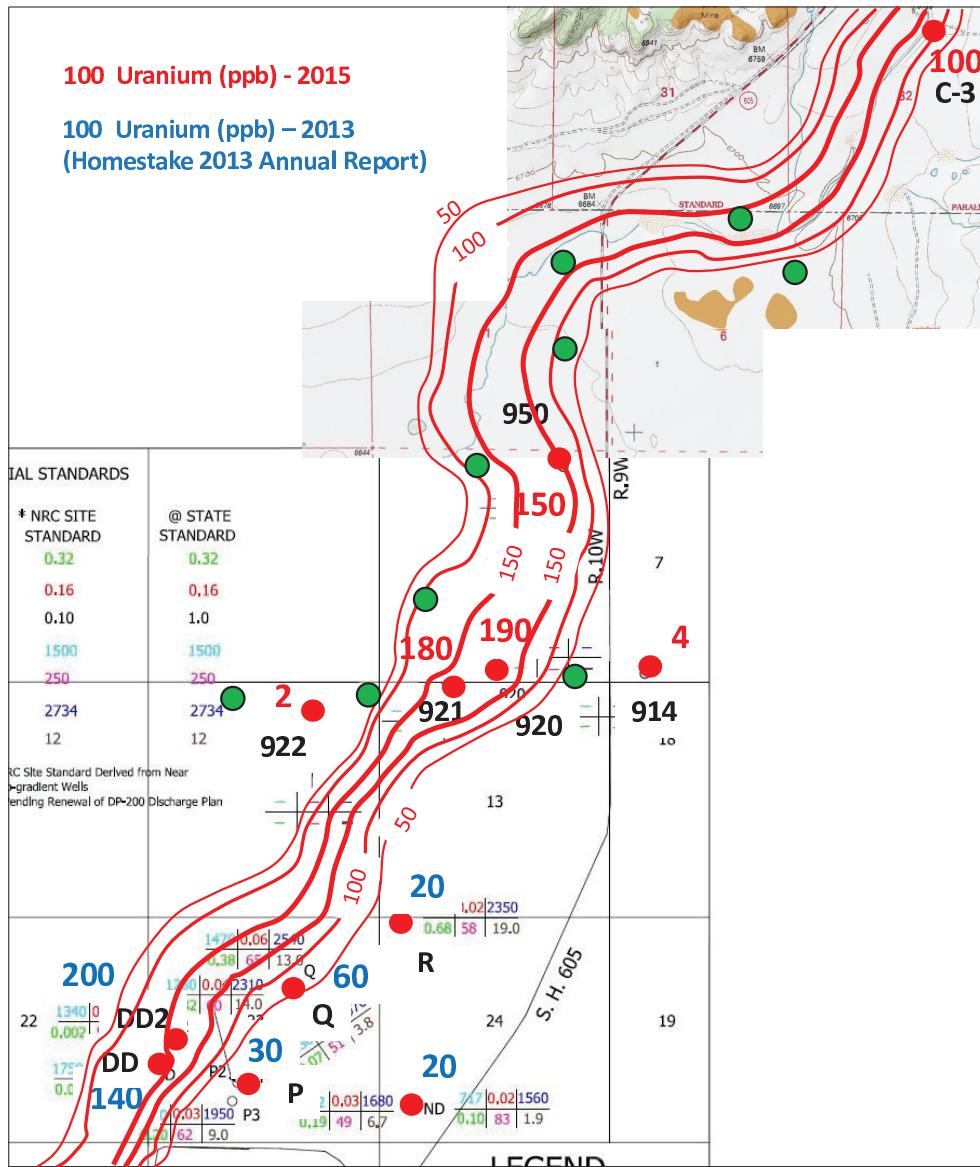
Homestake 2013 Annual Report



CROSS-SECTION E-E'

Changes to Alluvium Saturation Level Over Time
North of Homestake LTP





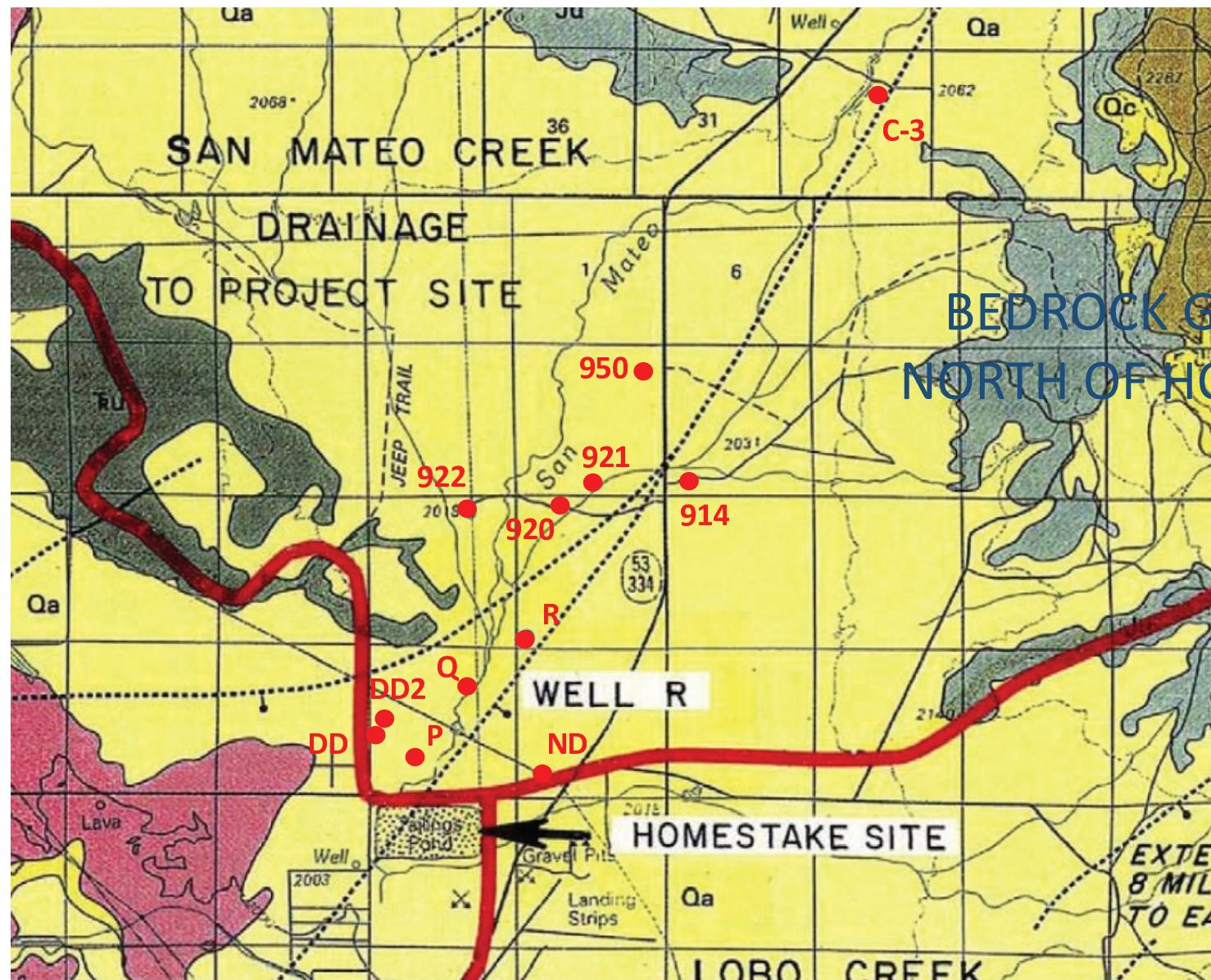
PLANNED EPA ALLUVIAL MONITORING WELLS NORTH OF HOMESTAKE 2015

San Mateo Creek Basin
Ground Water Investigation

● Planned Alluvial Monitoring Well

Base map from Homestake 2013 Annual Report
Data from EPA's San Mateo Creek ground water investigation,
Homestake 2013 Annual Report

BEDROCK GEOLOGY NORTH OF HOMESTAKE



CHINLE AQUIFERS

BACKGROUND WATER QUALITY ASSESSMENT

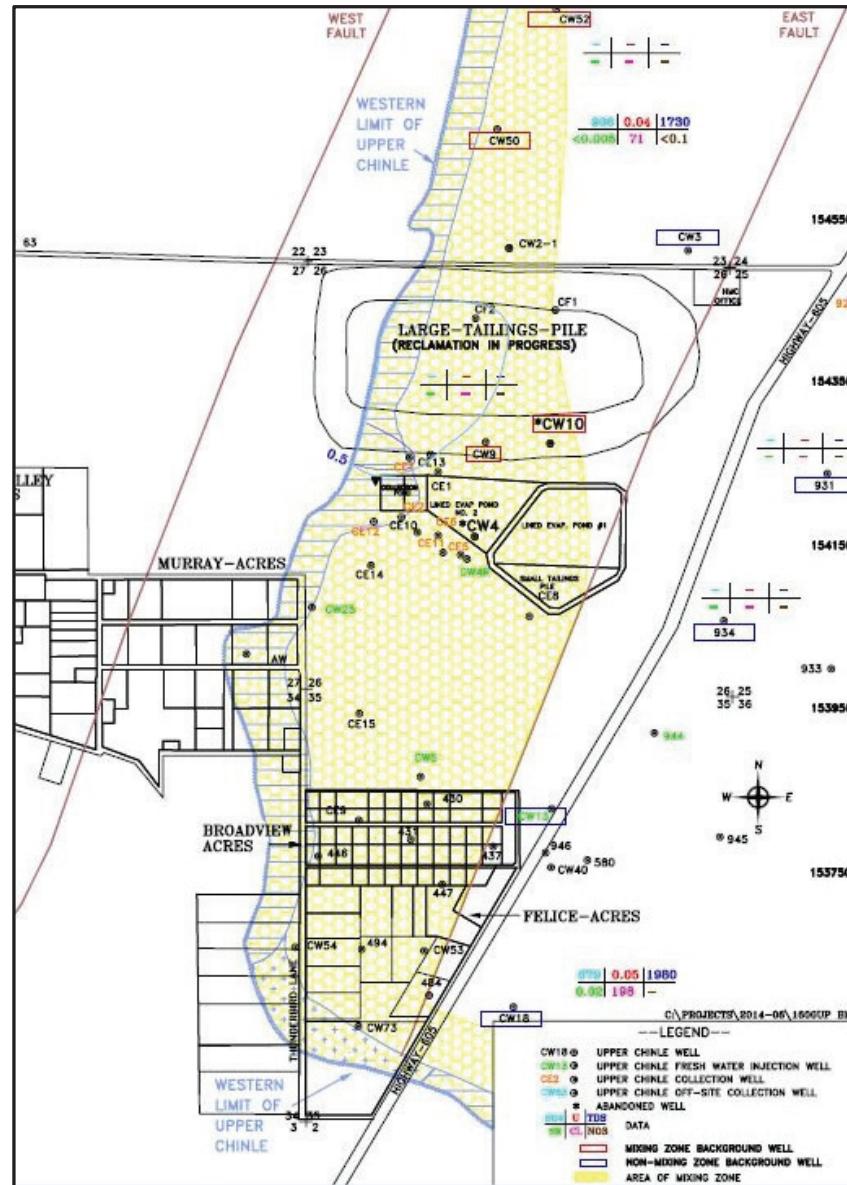
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- CW3 – 1984 to 2001*
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Map from Homestake 2013 Annual Report

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	CW-52*	9-41	17-28	<30		
	CW-9	<8.5-55	<10-25	<30-110		
	CW-10	12-50	<1-7	<10-20		
Cleanup Standards (NMZ)		90	60	100	914	2010
Non-Mixing Zone	CW-3	02-76	05-68	10-50	566-1,050	920-2,130
	CW-13	45-96	36-244	<30		
	CW-18	16-148	<10-129	<30-50		
	931	04-50 (144?)	05-30	10-110 (420)	608-779	1,290-2,160
	934	08-93 (361)	05-63	10-230	620-821	1,549-1,930

*Only two sampling events data available

Data from Homestake 2003 Statistical Evaluation Report

MIDDLE CHINLE

Mixing Zone Wells

- CW-15, CW-17, CW-24, CW-35, WR25 - Reasonable

Non- Mixing Zone Wells

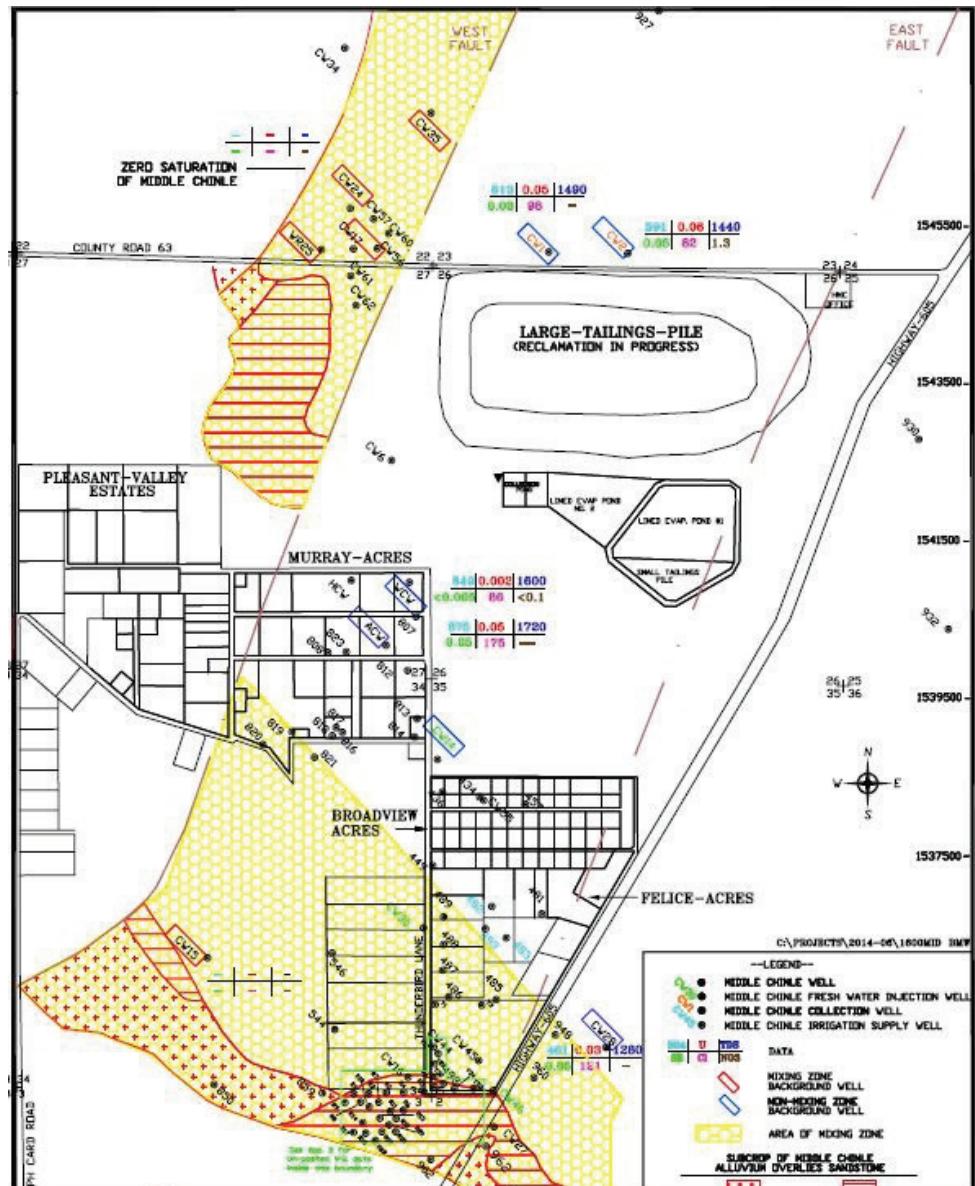
- CW1, CW2 CW-28, ACW, WCW - Reasonable
- CW-14 appears impacted by Se
- Why not use 930 or 932 for background?

Data Availability

- CW-1 and CW-2 – 1982-2003
- CW-14- 3 samples from 1995
- CW-28 – 1995-2003
- WCW- 1980-2000

Why is chemistry in Mixing Zone west of west fault used for background in east of west fault

Map from Homestake 2013 Annual Report



MIDDLE CHINLE BACKGROUND WELL DATA

Data from Homestake 2013 Statistical Evaluation Report

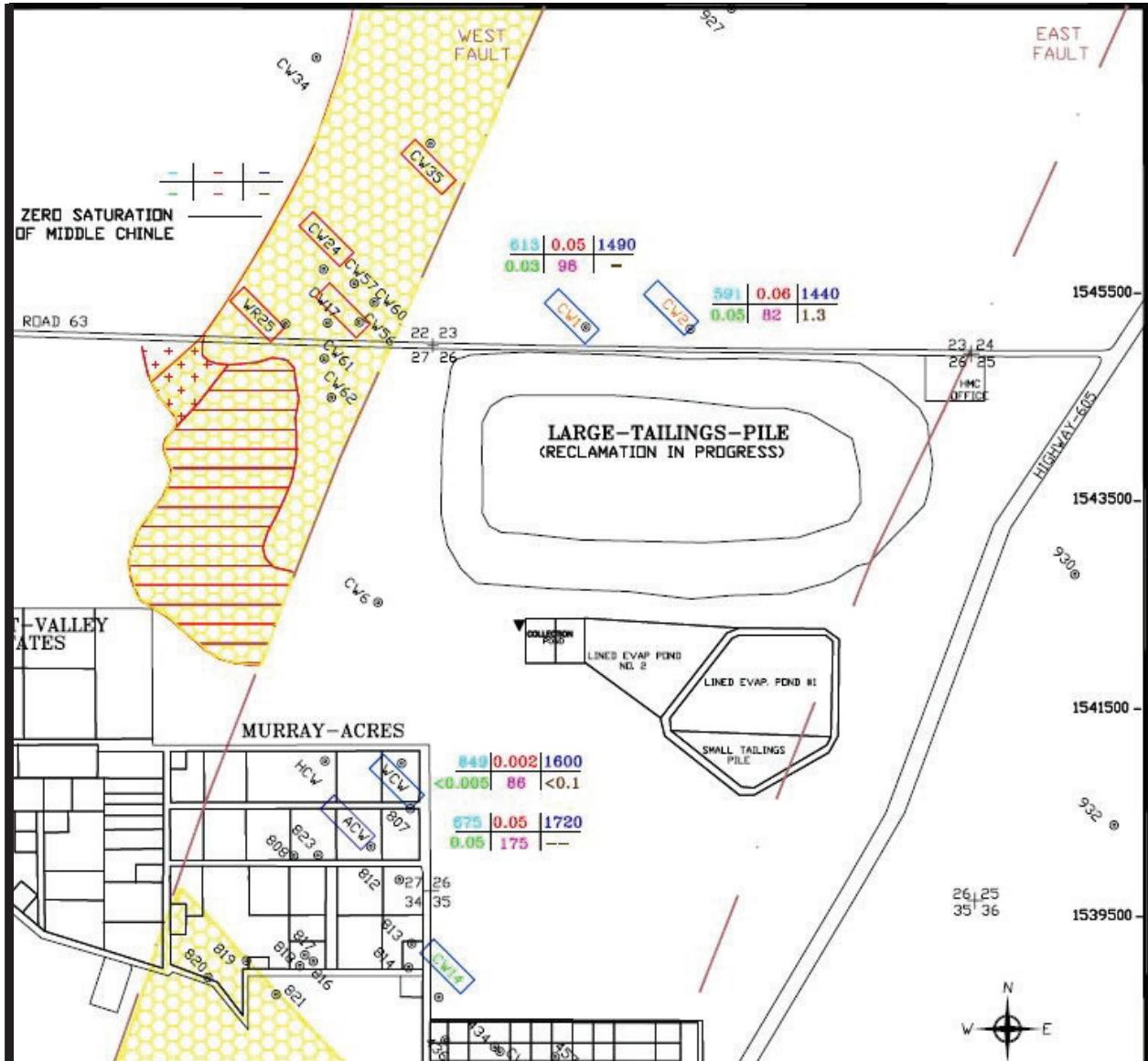
	Well	Uranium	Selenium	Molybdenum	Sulfate	TDS	
Cleanup Standards (MZ)		180	140	100	1750	3140	
Mixing Zone	CW-15	15-50	11-42	<30		1446-1710	C/E Block
	CW-17	69-175	69-116	<30-70		1620-3250	Western Block
	CW-24	101-154	34-79	<30-40		3020-3160	
	CW-35	141-231	12-520	<30		1830-2370	
	WR-25						
Cleanup Standards (NMZ)		70	70	100	857	1560	
Non-Mixing Zone	CW-1	<8.5-62	11-90	<30-40		2020-2514	Central and Eastern Block
	CW-2	<8.5-69	<10-30	<10-50		860-2280	
	CW-28	11-61	16-83	<30-30		944-1410	
	ACW	<8.5-25	<10-10	<10-30		1172-1470	
	WCW	<8.5-33	<10-20	<10-30		1170-1980	
	CW-14	10-19	83-222	<30		1306-1486	

MIDDLE CHINLE

Other Issues for Mixing Zone

- No Non-Mixing Zone water quality west of West Fault?
- Downgradient Extent of Mixing Zone west of West Fault not delineated?

Map from Homestake 2013 Annual Report



LOWER CHINLE

Mixing Zone Wells

- CW-26, CW-29, CW-31, CW-32, CW-33, CW-41
- Background levels seem high

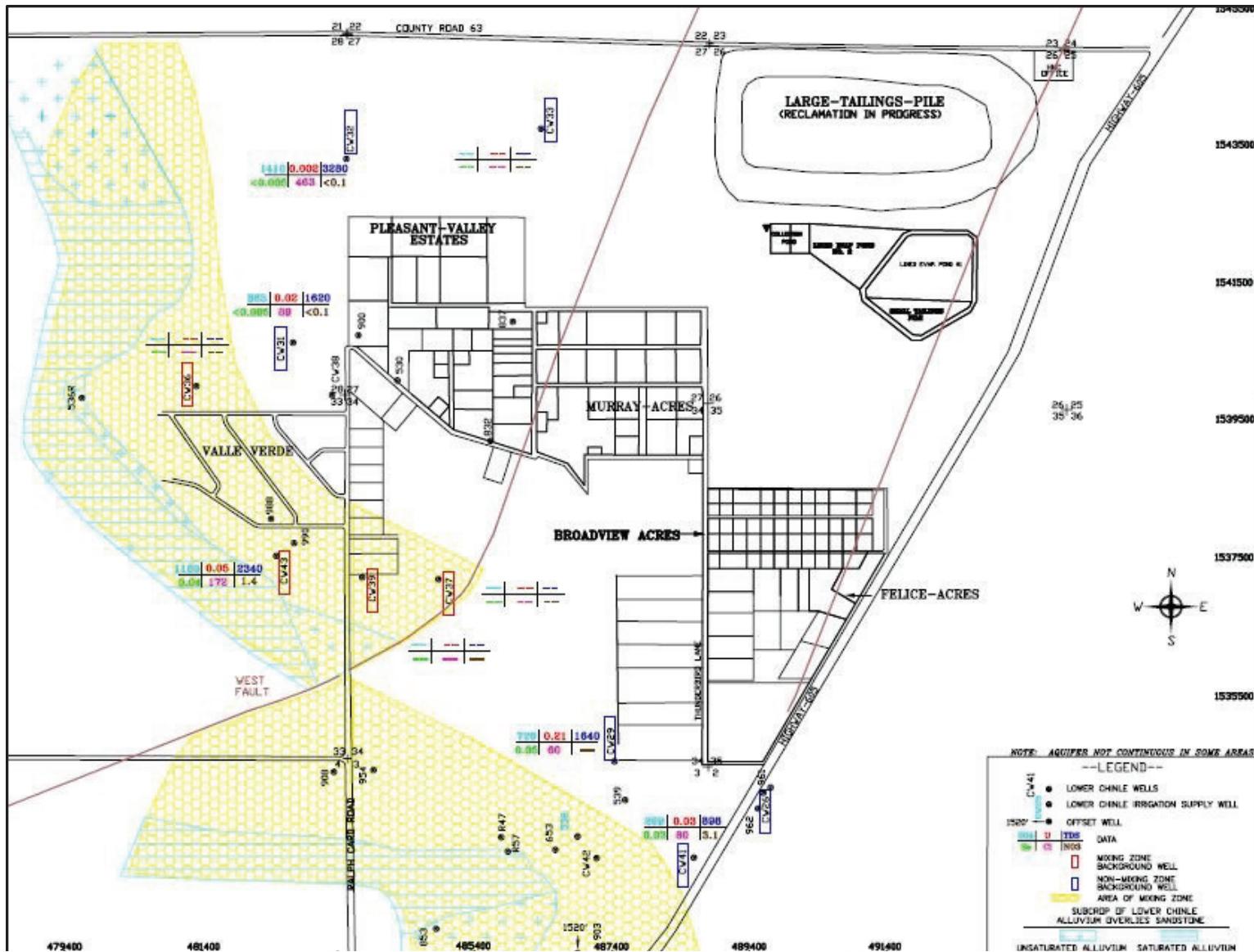
Non-Mixing Zone Wells

- Selenium in C/E Blocks seems high for Non-Mixing Zone
- Water quality is better in private wells than in background monitor wells

Data Availability

- All Wells – 1995-2002 except CW-41
- CW-41-1996-1998

Map from Homestake 2013 Annual Report



LOWER CHINLE BACKGROUND WELL DATA

	Well	Uranium	Selenium	Molybdenum	Sulfate	TDS
Cleanup Standards (MZ)		180	140	100	1750	3140
Mixing Zone	CW-36	2-13	<5-35	<30		
	CW-37	24-32	75-96	<30		
	CW-39	17-45	31-85	<30		
	CW-43	21-33	9-25	<30		
<hr/>						
Cleanup Standards (NMZ)		30	320	100	2000	4140
Non-Mixing Zone	CW-26	16-24	192-364	<30-120		
	CW-29	9-53	<14-155	<30		
	CW-31	6-16	<5	<30		
	CW-32	6-10	<10-2570	<30		
	CW-33	<10-26	<10-14	<30		
	CW-41	13-48	8-24	<30		

Data from Homestake 2003 Statistical Evaluation Report

LOWER CHINLE - PRIVATE WELL DATA

(select wells southeast
of Felice Acres)

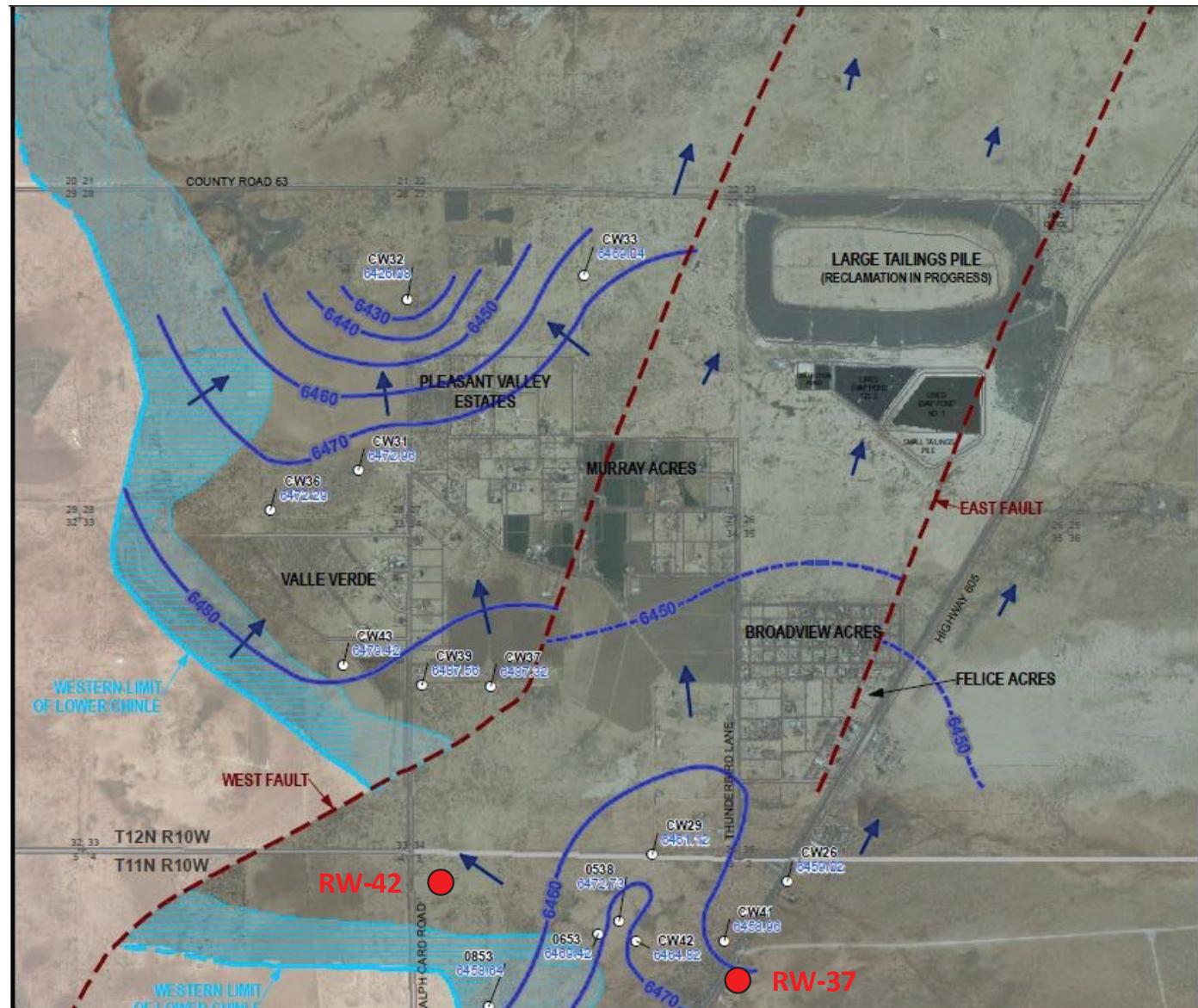
Well	Uranium (ppb)	Selenium (ppb)	TDS (ppm)
RW-37 (963)	15	12	700
RW-38 (572)	11	8	598
RW-42 (954)	6	2	934
RW-44 (574)	17	9	606
RW-47 (964)	16	11	658

Data from NMED Summary Report on 2005-2007 Residential Sampling

GROUND WATER FLOW MAP

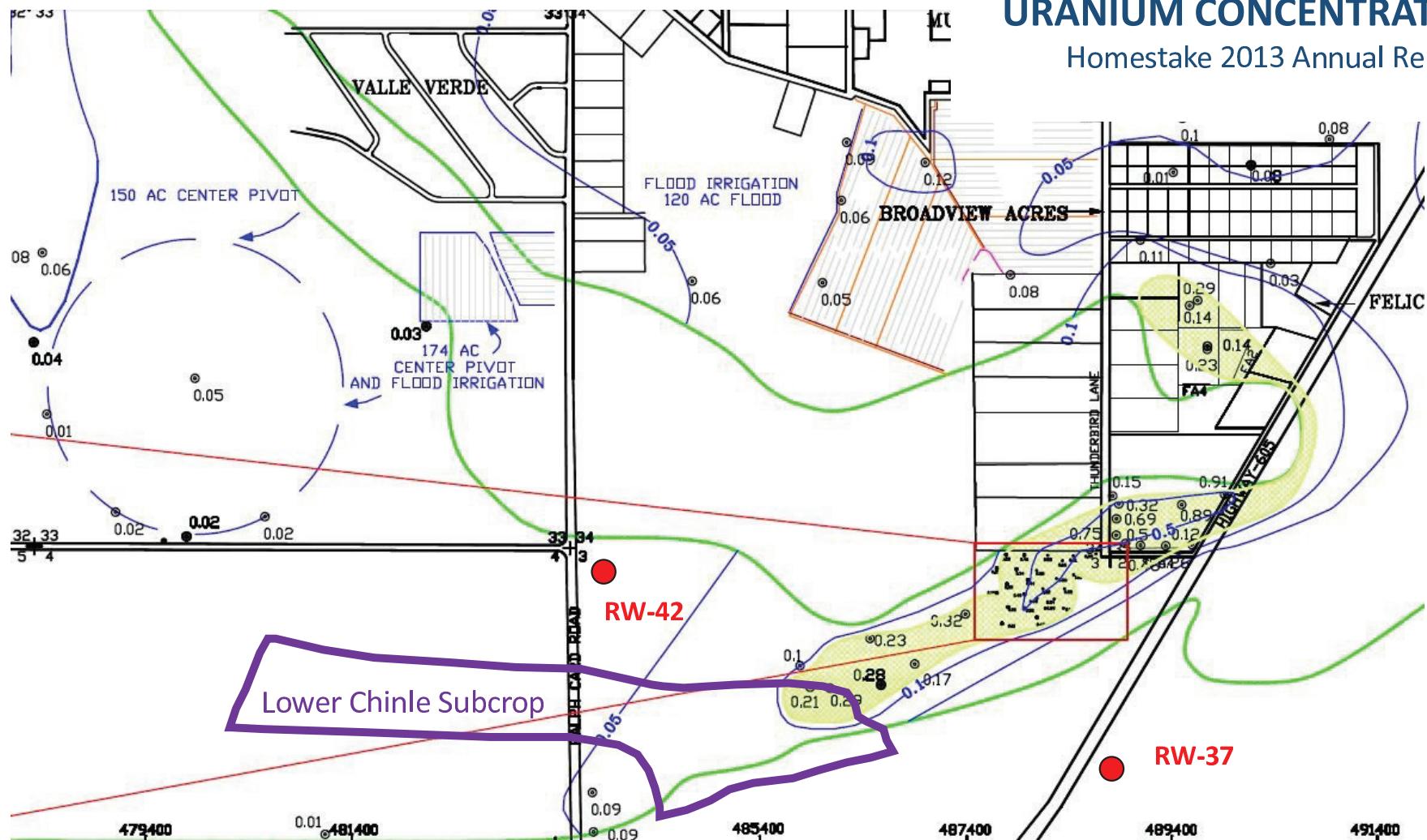
Lower Chinle

Homestake CAP



URANIUM CONCENTRATION MAP

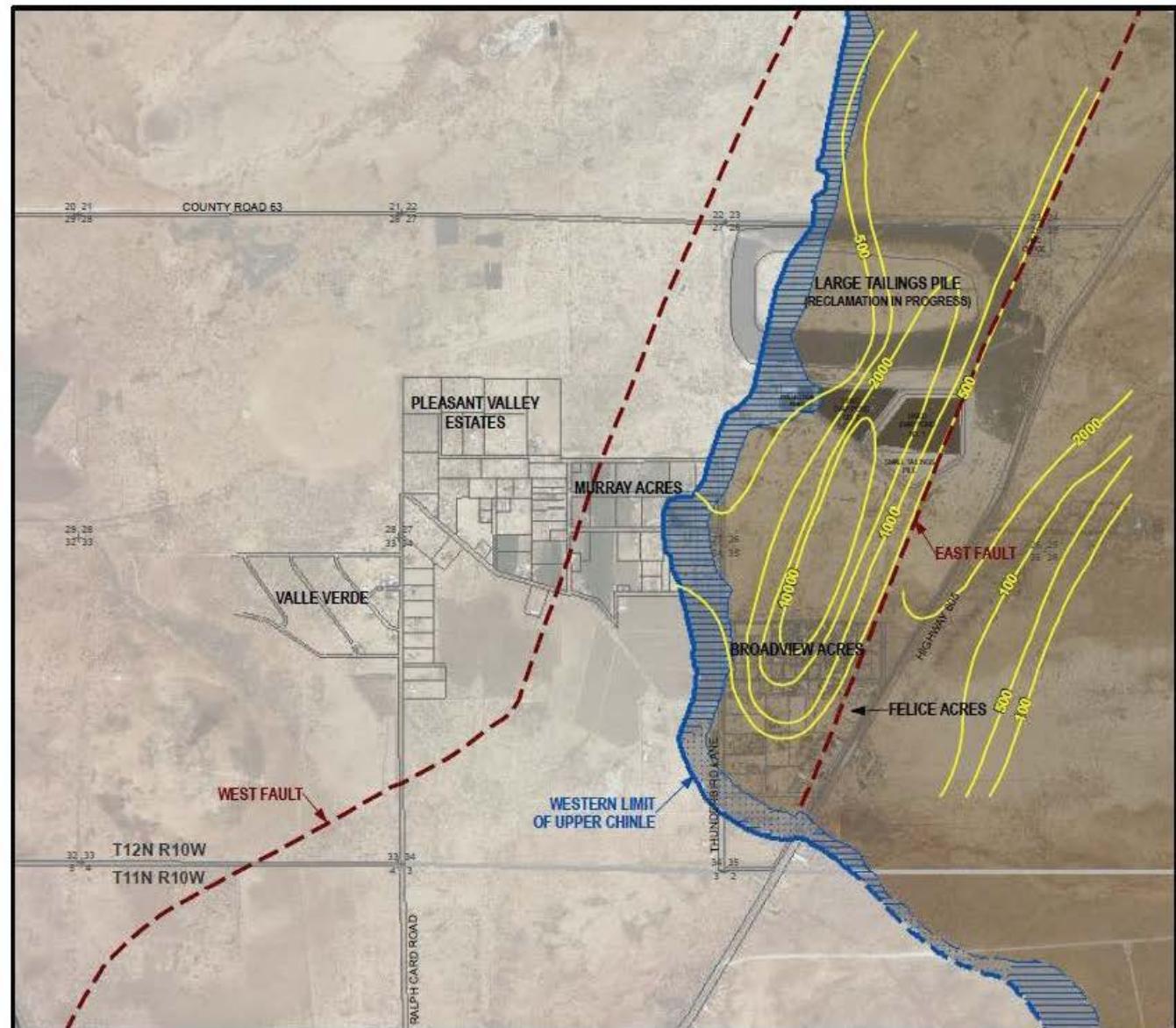
Homestake 2013 Annual Report



TRANSMISSIVITY

Upper Chinle

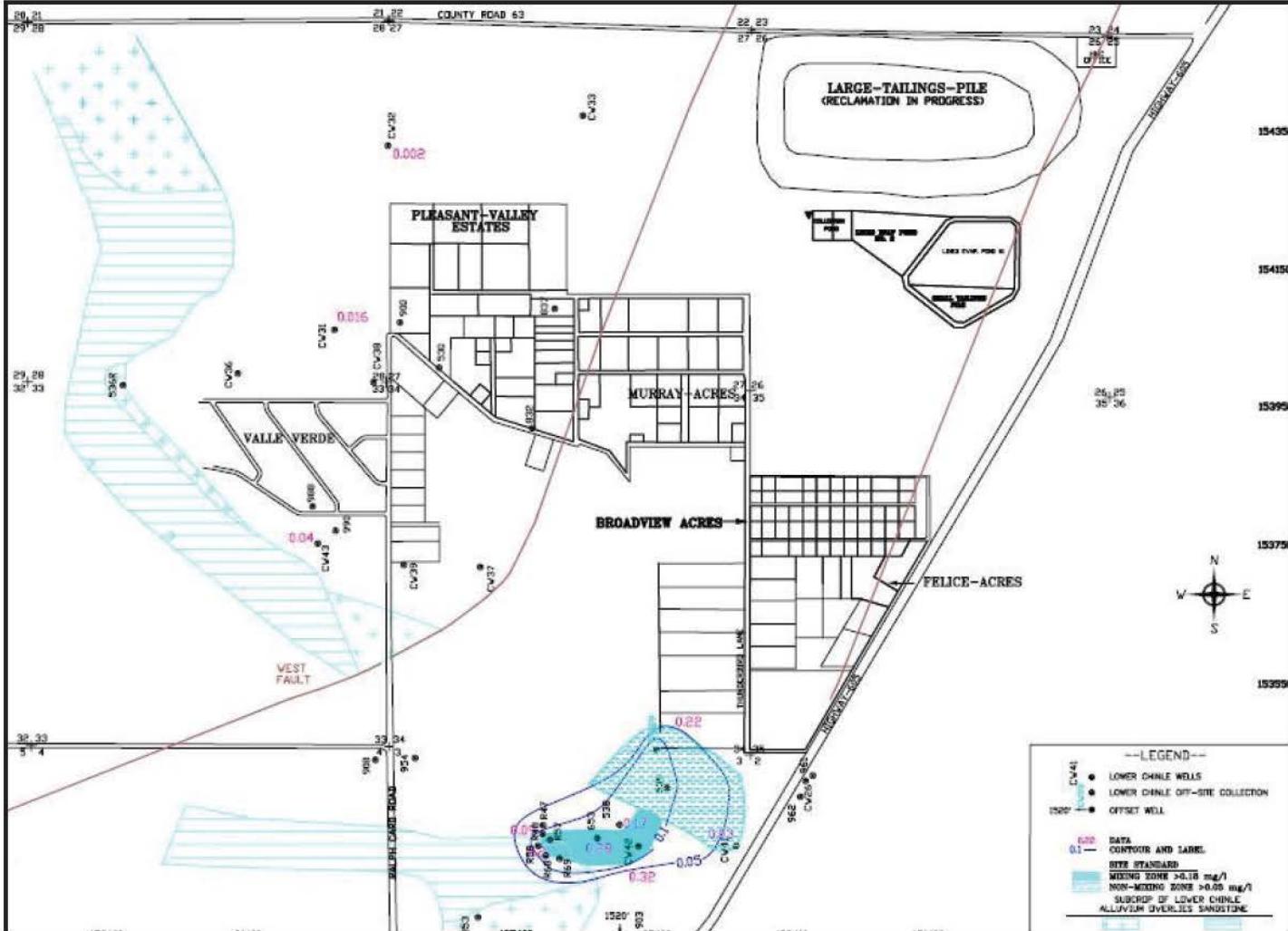
Homestake CAP



URANIUM CONCENTRATION MAP

Lower Chinle

Homestake 2013 Annual Report



GROUND WATER FLOW MAP

Lower Chinle

Homestake CAP

